[redacted]ENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
N75469ARJB/C		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/EP 99/ 08131	27/10/1999	28/10/1998
Applicant		
CRYOVAC, INC. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 2

   [X] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
P[redacted] 99/08131

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65B31/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65B B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 380 812 A (IMDUT INT BV) 8 August 1990 (1990-08-08) figures 4,5,8	1-3,5,6, 11,12,19
A	WO 98 12111 A (CAPPI ANGELO ;RIMONDI RENATO (IT); AWAX PROGETTAZIONE (IT)) 26 March 1998 (1998-03-26) figures 3-5	1,2,5, 11,18
A	EP 0 836 996 A (FURUKAWA SEISAKUSHO KK) 22 April 1998 (1998-04-22) figures 3,4	1
A	US 3 816 969 A (ZIMMERMAN T ET AL) 18 June 1974 (1974-06-18) the whole document	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 May 2000	12/05/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Béraud, F

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
EP 99/08131

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0380812 A	08-08-1990	AU 4810090 A	01-08-1990
		BR 8907291 A	12-03-1991
		CA 2006765 A	02-07-1990
		DK 170890 A	16-07-1990
		WO 9007452 A	12-07-1990
		NO 903818 A	31-08-1990
WO 9812111 A	26-03-1998	IT B0960465 A	18-03-1998
		EP 0932550 A	04-08-1999
EP 0836996 A	22-04-1998	US 5752369 A	19-05-1998
		DE 69603966 D	30-09-1999
		DE 69603966 T	06-04-2000
US 3816969 A	18-06-1974	CA 967474 A	13-05-1975
		CA 971869 A	29-07-1975
		CA 971870 A	29-07-1975
		CA 971871 A	29-07-1975
		US 3908337 A	30-09-1975

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 29 June 2000 (29.06.00)	
International application No. PCT/EP99/08131	**Applicant's or agent's file reference** N75469ARJB/C
International filing date (day/month/year) 27 October 1999 (27.10.99)	**Priority date** (day/month/year) 28 October 1998 (28.10.98)
Applicant EVANGELISTI, Riccardo et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

10 May 2000 (10.05.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Manu Berrod
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
N.75469ARJB		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP99/08131	27/10/1999	28/10/1998
International Patent Classification (IPC) or national classification and IPC B65B31/02		
Applicant CRYOVAC, INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
10/05/2000	16.01.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Polderdijk, S Telephone No. +49 89 2399 2314

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP99/08131

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:
Description, pages:

1-12 as originally filed

Claims, No.:

1-21 as originally filed

Drawings, sheets:

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-21
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-21
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-21
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

1. Reference is made to the following document:
   D1: EP0380812A.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

2. Document D1 is considered to represent the most relevant state of the art. It discloses (see Figs. 2 - 13) a vacuum packaging machine for performing a vacuum sealing operation on product packages, comprising vacuum chambers each arranged to receive at least one unsealed product package and operable to perform an independent vacuum sealing operation on the at least one product package. The packaging machine according to independent claim 1 differs from this prior art in that the vacuum chambers (4) are arranged in a vertical stack (in D1 they are next to each other in a horizontal plane).
   The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

3. The problem to be solved by the present invention may be regarded as increasing the capacity of a vacuum packaging machine by increasing the number of vacuum chambers, without substantially increasing the amount of space used. Increasing the capacity in a machine such as according to D1 and other available prior art documents such as WO9812111A and EP0836996A (by adding vacuum chambers next to existing vacuum chambers) would increase the amount of space used. The claimed solution, namely to arrange the vacuum chambers in a vertical stack and thus saving space, has not been suggested by the available prior art documents.
   The solution to this problem proposed is therefore considered as involving an inventive step (Article 33(3) PCT).

4. Claims 2 to 21 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

5. The subject-matter of the claims can also be considered industrially applicable (Article 33(4) PCT).

Re Item VII

Certain defects in the international application

6.1 Independent claim 1 is not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

6.2 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

7.1 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

7.2 It seems that Figures 10 and 11 should be interchanged (compare page 4, lines 28 - 30 with Figs. 10 and 11).

Re Item VIII

Certain observations on the international application

8. Claim 1 specifies the vacuum chambers as being arranged in a vertical stack, thus distinguishing from the prior art according to D1, where two (or more) vacuum chambers are arranged next to each other in a horizontal plane, ie horizontally spaced. However, on page 10 (lines 1 and 2) of the description it is stated that the spacing between the vacuum chambers need not be vertical; they may instead be horizontally spaced or in a 2-dimensional array. This statement in the description implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity (Article 6 PCT) when used to interpret them (see also the PCT Guidelines, III-4.3a).
It is noted that such an interpretation of the subject-matter of claim 1 would put its novelty in doubt in the light of the disclosure of D1.

CORRECTED VERSION*

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : B65B 31/02

A3

(11) International Publication Number: WO 00/27706

(43) International Publication Date: 18 May 2000 (18.05.00)

(21) International Application Number: PCT/EP99/08131

(22) International Filing Date: 27 October 1999 (27.10.99)

(30) Priority Data:
98308823.8 28 October 1998 (28.10.98) EP

(71) Applicant *(for all designated States except US)*: CRYOVAC, INC. [US/US]; 100 Rogers Bridge Road, Building A, Duncan, SC 29334–0464 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: EVANGELISTI, Riccardo [IT/IT]; Via Vergiate, 3, I–20151 Milano (IT). CAILLIER, Joel [FR/FR]; 44 Grand Pre, F–69210 Lentilly (FR).

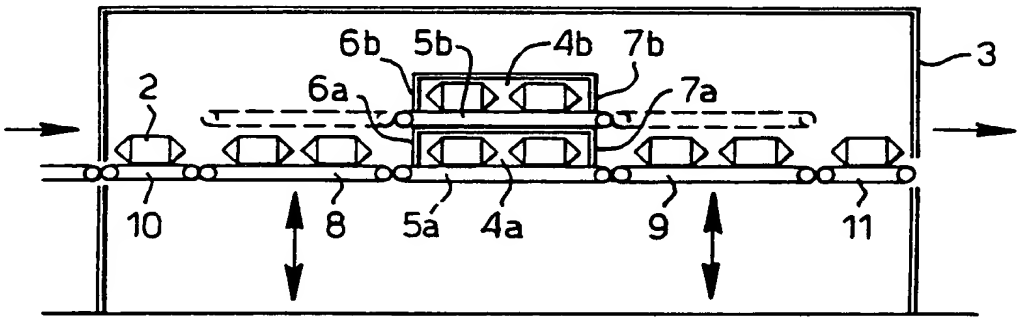
(74) Agents: BARLOW, Roy, James et al.; J.A. Kemp & Co., 14 South Square, Gray's Inn, London WC1R 5LX (GB).

(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(88) Date of publication of the international search report:
3 August 2000 (03.08.00)

(54) Title: VACUUM PACKAGING MACHINE



(57) Abstract

A vacuum packaging machine for performing a vacuum sealing operation on product packages, comprises a vertical stack of vacuum chambers (4) which each manage to receive at least one unsealed product package (2) and are operable to perform an independent vacuum sealing operation on the at least one product package (2). A conveyor arrangement (8, 9) is operable to load and unload a selected vacuum chamber (4) with the at least one product package, and the machine is arranged to operate the respective vacuum chambers (4) to perform the vacuum sealing operation while the conveyor arrangement is operated to load and unload another vacuum chamber (4). The conveyor arrangement loads and unloads the vacuum chambers in sequence, and the vacuum chambers are synchronously operated to perform the vacuum sealing operation to allow the conveyor arrangement to operate continuously. The conveyor arrangement comprises at least one in–feed conveyor (8) and at least one out–feed conveyor (9) which are independently movable to select the vacuum chamber to be loaded and unloaded. There may be a plurality of in–feed conveyors (8) and a plurality of out–feed conveyors (9). The vacuum chambers each have a sealing bar arranged along one side for sealing the product packages (2).

*(Referred to in PCT Gazette No. 44/2000, Section II)

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

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VACUUM PACKAGING MACHINE

The present invention relates to a vacuum packaging machine for performing a vacuum sealing operation on product packages.

Vacuum packaging machines of a known type comprise a vacuum chamber arranged to receive at least one unsealed product package and operable to perform a vacuum sealing operation on the at least one product package. Typically the product packages are products such as food stuff arranged in a bag formed by a heat-shrinkable film. After loading and closing the vacuum chamber, the vacuum sealing operation normally comprises vacuumisation, sealing the mouth of the vacuumised bags, and reintroducing air into the chamber. Then the chamber is opened and the vacuum chamber is unloaded. The product packages may then be conveyed to a heat-shrinking unit, typically a hot water tunnel or a dip tank.

The vacuumisation step typically takes at least 20-30 seconds which is mostly wasted time in the overall packaging process. During this time, the only step which can be taken is to prepare the next product packages for loading into the vacuum chamber, for example by conveying them onto an in-feed conveyor. Accordingly, the vacuum packing machine causes a bottle-neck in the overall packaging process.

According to the present invention, there is provided a vacuum packaging machine for performing a vacuum sealing operation on product packages, comprising a vertical stack of vacuum chambers each arranged to receive at least one unsealed product package and operable to perform an independent vacuum sealing operation on the at least one product package.

The provision of more than one vacuum chamber in the vacuum packaging machine allows respective vacuum chambers to perform a vacuum sealing operation while another vacuum chamber is being loaded and/or unloaded. Therefore, the machine may minimise the wasted time in the vacuum packaging process. Consequently, the present invention can increase through-put and increase productivity of a packaging line including the machine. Furthermore, by arranging the vacuum chambers in a vertical stack, this increase in productivity may be

achieved without significantly increasing the floor area of the vacuum packaging machine. The extra vacuum chambers only increase the height of the machine. This is a significant advantage in manufacturing plants where increasing the footprint of the vacuum packaging machine would create real problems but where there is normally space to increase the height of the machine.

Preferably, the vacuum packaging machine further comprises a conveyor arrangement operable to load and unload a selective vacuum chamber with the at least one product package, the machine being operable to operate the respective vacuum chambers to perform the vacuum sealing operation while the conveyor arrangement is operated to load and unload another vacuum chamber.

The conveyor arrangement can automatically load and unload selected vacuum chambers. Operation of one or more of the vacuum chambers while the conveyor arrangement is loading and unloading another vacuum chamber reduces the amount of time wasted, thereby increasing through-put and increasing productivity of a packaging line including the machine.

Preferably, the machine is operable to operate the conveyor arrangement to load and unload the vacuum chambers in a cyclical sequence and synchronously to operate the respective vacuum chambers to perform the vacuum sealing operation on the at least one product packages after loading.

Such a cyclical operation allows the machine to be utilised in an automatic continuous packaging line. It is desirable that the number of vacuum chambers is sufficient relative to the duration of the vacuum sealing operation to allow the conveyor arrangement to operate continuously because this minimises the amount of wasted time. Time wastage can be reduced further by designing the conveyor arrangement to load and unload the vacuum chambers more rapidly. The described embodiments include particularly suitable conveyor arrangements as follows.

Preferably, the conveyor arrangement includes at least one in-feed conveyor operable to load a selected vacuum chamber with the at least one product package.

Preferably, the conveyor arrangement includes at least one out-feed conveyor operable to unload a selected vacuum chamber with the at least one product package, although as an alternative the in-feed conveyor may be operable in reverse to unload

a selected vacuum chamber.

Provision of separate in-feed and out-feed conveyors allows the loading and unloading to occur simultaneously, preferably with the in-feed and out-feed conveyors being linked by an internal conveyor in each vacuum chamber.

Preferably, the at least one in-feed conveyor and/or the at least one out-feed conveyor are vertically movable to select the vacuum chamber to be loaded. Additionally or alternatively, the plurality of vacuum chambers are movable together relative to the conveyor arrangement to select the vacuum chamber to be loaded and unloaded.

The conveyor arrangement may include a plurality of in-feed conveyors and/or out-feed conveyors which are movable together. In this case, the vacuum chambers are preferably have a regular spacing and the in-feed conveyors and/or out-feed conveyors have a relative spacing equal to the spacing between the vacuum chambers. This allows more than one vacuum chamber to be loaded and/or unloaded simultaneously.

Desirably, the vacuum chambers each have a sealing bar arranged along a side of the respective vacuum chamber for sealing the at least one product packages, preferably extending along the internal conveyor. This prevents the sealing bar from hindering loading and unloading improves the automatic operation of the machine because the product packages always have the same orientation.

Advantageously, the vacuum chambers and/or the in-feed conveyors and/or the out-feed conveyors have a modular construction. This allows the modular parts to be added and removed in order to assemble the machine with a variable number of the parts in order to provide a productivity and cost appropriate to the particular packaging line in which the machine is used. Thus, this modular construction increases the flexibility of the machine and allows it to be used in different packaging lines. This flexibility is particularly advantageous with the vacuum chambers being arranged in a vertical stack because the productivity of the machine may be altered whilst covering the same floor space within the manufacturing plant because only the height of the machine is altered.

Advantageously, each vacuum chamber comprises at least two parts which

are relatively vertically movable to open and close the vacuum chamber. This construction for the vacuum chambers is advantageous because it allows for a simple machine design, lower manufacturing costs and simple servicing and maintenance operations as compared to a vacuum chambers which are open and closed by the provision of doors.

In order that the present invention may be better understood, the following description of preferred embodiments is given by way of non-limitative example with reference to the accompanying drawings in which:

Fig. 1 is a top plan view of a packaging line including a vacuum packaging machine which is a first embodiment of the present invention;

Fig. 2 is a schematic sectional side view of a first arrangement for a vacuum packaging machine according to the present invention;

Fig. 3 is a schematic sectional side view of a second arrangement for a vacuum packaging machine according to the present invention;

Fig. 4 is a schematic sectional side view of a third arrangement for a vacuum packaging machine according to the present invention;

Fig. 5 is a schematic sectional side view of a fourth arrangement for a vacuum packaging machine according to the present invention;

Fig. 6 is a detailed side view of a vacuum packaging machine according to the present invention;

Fig. 7 is a partial enlarged view of the vacuum packaging machine shown in Fig. 6 and showing a vacuum chamber and a drive mechanism for opening and closing a vacuum chamber in an overlapping view;

Fig. 8 is a side view of the drive mechanism of Fig. 7 in isolation in a first position;

Fig. 9 is a cross-sectional view taken along line IX-IX of the drive mechanism in the first position of Fig. 7;

Fig. 10 is a side view of the drive mechanism in the second position; and

Fig. 11 is a cross-sectional view taken along line XI-XI of the drive mechanism in the second position of Fig. 10.

Fig. 1 is a top plan view of a vacuum packaging machine 1 which is an

embodiment of the present invention arranged in a packaging line 13 constituted by a series of conveyors. At a bagging section 14, products are bagged in heat-shrinkable film bags, or alternatively in small pouches made from thin films, and arranged on line 13 as product packages 2. A vacuum packaging machine 1 performs a vacuum sealing operation on the product packages 2 which are then output back onto the packaging lines 13 which conveys them through a shrink tunnel 15 to perform a heat-shrinking operation. The product packages 2 move continuously through the shrink tunnel 15 which is advantageous over heat-shrinking of products in batches where it is difficult to obtain uniform shrinking of the packaging around each product as a result of contact or proximity between the various product packages 2.

Figs. 2 to 5 are sectional side views of various arrangements for the vacuum packaging machine 1. Figs. 2 to 5 are schematic for ease of understanding of the overall arrangement and operation. Details of the structure of the vacuum packaging machine are given subsequently.

The vacuum packaging machine 1 has a body 3 supporting a plurality of vertically stacked vacuum chambers 4. As can be seen in Fig. 1, since the vacuum chambers 4 are stacked vertically, they only occupy the same floor space as a single vacuum chamber. Except as described below, each vacuum chamber 4 is in itself of conventional construction and performs a vacuum sealing operation in a conventional manner.

Each vacuum chamber 4 has a modular construction allowing vacuum chambers to be added or removed from the vacuum packaging machine 1. For example, in the arrangement illustrated in Fig. 2, there are two vacuum chambers 4a, 4b. In the arrangements illustrated in Figs. 3 and 4, an additional vacuum chamber 4c has been added so that there are three vacuum chambers 4a, 4b, 4c. In the arrangement illustrated in Fig. 5, there are four vacuum chambers, 4a, 4b, 4c, 4d.

Each vacuum chambers 4 has an internal chamber conveyor 5 to convey product packages 2 therethrough, and a respective sealing bar 12 arranged along one side of the chamber extending along the corresponding chamber conveyer 5. Provision of a sealing bar 12 on the side of the chamber conveyor 5 facilitates automatic feeding and loading is made easier by the bags being orientated in the

same direction.

Each chamber has a respective entrance 6 and exit 7. Opening and closing of the vacuum chambers is described in more detail subsequently.

At least one in-feed conveyor 8 and at least one out-feed conveyor 9 are provided on opposite sides of the vacuum chambers 4 facing entrances 6 and exits 7. The in-feed and out-feed conveyors 8, 9 are independently vertically moveable, for example between a lower position shown in bold outline in Fig. 2 for loading and unloading the lower vacuum chamber 4a and a higher position shown in dotted outline in Fig. 2 for loading and unloading the upper vacuum chamber 4b.

The in-feed conveyors 8 and the out-feed conveyors 9 have a modular construction allowing additional conveyors to be added or removed. In the arrangements illustrated in Figs. 2 and 3 only a single in-feed conveyor 8 and an out-feed conveyor 9 are used. In the arrangements illustrated in Figs. 4 and 5, conveyors have been added so that there are a pair of in-feed conveyors 8a, 8b and a pair of out-feed conveyors 9a, 9b. Where plural in-feed or out-feed conveyors 8, 9 are provided, these are arranged in a vertical stack with the in-feed conveyors 8 being moveable together as a unit and the out-feed conveyors being moveable together as a unit.

A fixed input conveyor 10 is provided to receive unsealed product packages 2 into the machine 1 from station 14 along packaging line 13 and supply them to the in-feed conveyor 8. Another fixed output conveyor 11 receives sealed packages 9 from the out-feed conveyor 9 and outputs them along line 13.

In an alternative construction, the at least one in-feed and out-feed conveyors 8, 9 are fixed in the position shown in bold in Fig. 2 and the vacuum chambers 4 are movable together vertically between upper position, as shown in Fig. 2, for loading and unloading the lower vacuum chamber 4a and a lower position in which the vacuum chamber 4b is aligned with in-feed and out-feed conveyors 8, 9 for loading and unloading.

All the conveyors 5, 8, 9, 10, 11 are indexed, that is they are driven to execute an indexing motion.

The vacuum chambers 4 are illustrated as accommodating two product packages 2, but they may be dimensioned to accommodate any number of product

packages 2.

The vacuum packaging machine 1 is operated in a continuous cycle controlled by an electronic control unit (not shown), although manual control is an alternative possibility. Loading and unloading of the vacuum chambers 4 is performed in a cyclical sequence and the vacuum chambers are synchronously operated to perform a vacuum sealing operation on the loaded product packages 2, including vacuumisation and sealing of the product packages 2 using the sealing bar 12. In general the provision of plural vacuum chambers 4 allows the vacuum sealing operation to be performed in one vacuum chamber 4 whilst another vacuum chamber 4 is being loaded and unloaded.

Normally, the at least one in-feed conveyor 8 and out-feed conveyor 9 are synchronously moved vertically. An opposed in-feed conveyor 8 and out-feed conveyor 9 adjacent the fixed conveyors 10, 11 are operated synchronously to receive product packages 2 from the fixed input conveyor 10 and to supply sealed product packages to the fixed output conveyor 11, and are then moved adjacent one of the vacuum chambers 4. Similarly, an opposed in-feed conveyor 8 and out-feed conveyor 9 adjacent a given vacuum chamber 4 are operated synchronously to load the given vacuum chamber 4 with unsealed product packages 2 and simultaneously to unload the same vacuum chamber 4 with the sealed product packages 2.

The advantage of providing plural in-feed and out-feed conveyors 8, 9 (as in the arrangements illustrated in Figs. 4 and 5) is that a given vacuum chamber 4 may be loaded and unloaded using a first in-feed conveyor 8 and out-feed conveyor 9 simultaneously with supply to and from a second in-feed conveyor 8 and out-feed conveyor 9 from and to the fixed conveyors 10 and 11.

The precise order of operation of the elements of the vacuum packaging machine 1 in a cycle depends on the number of vacuum chambers 4, in-feed conveyors 8 and out-feed conveyors 9 arranged in the vacuum packaging machine 1. A possible cycle for the arrangement of the vacuum packaging machine 1 illustrated in Fig 2 is as follows and is illustrative of the cycle for other arrangements.

As an arbitrary starting point within the cycle, we can take the point at which the vacuum sealing operation in the lower vacuum chamber 4a has just finished. At this time, the vacuum sealing operation in the upper vacuum chamber 4b is

underway. The lower vacuum chamber 4a is opened. Next, the fixed conveyors 10,11, the in-feed and out-feed conveyors 8, 9 and the lower chamber conveyor 5a are simultaneously operated (i) to load lower vacuum chamber 4a with new unsealed product packages from the in-feed conveyor 8, (ii) to unload the lower vacuum chamber 4a onto the out-feed conveyor 9, and (iii) to supply new unsealed product packages 2 onto the in-feed conveyor 8. Exact synchronisation is preferable but some degree of overlap may be desirable. The lower vacuum chamber 4a is then closed for commencement of the vacuum sealing operation, that is vacuumisation of the chamber 4a and sealing of the product packages 2 by sealing bar 12.

During the vacuum sealing operation in the lower vacuum chamber 4a, loading and unloading of the upper vacuum chamber 5 is performed. The out-feed conveyor 9 is operated briefly to clear sealed products off it. Then the in-feed and out-feed conveyors 8, 9 are raised to the upper vacuum chamber 4b and when the vacuum sealing operation in the upper vacuum chamber 4b has finished, the upper vacuum chamber 46 is opened. Simultaneous operation of the in-feed and out-feed conveyors 8, 9 and the upper chamber conveyor 5b loads and unloads the upper vacuum chamber 4b.

Subsequently, the upper vacuum chamber 4b is closed and the vacuum sealing operation in the upper vacuum chamber 4b is commenced. At the same time, the in-feed and out-feed conveyors 8, 9 are operated to load and unload the lower vacuum chamber 4a. That is to say, the in-feed and out-feed conveyors 8, 9 are lowered and then the in-feed conveyor 8 is operated simultaneously with the fixed conveyor 10 to fill the in-feed conveyor with new product packages 2 from in-feed conveyor 8 while the sealed packages move onto the out-feed conveyor 9.

The cycle then repeats.

Various modifications to the cycle are possible. For example, instead of simultaneously loading and unloading a vacuum chamber 4 by operating the in-feed and out-feed conveyor 8, a chamber conveyor 5 and out-feed conveyor 9 together, it is possible to operate in-feed conveyor 8 and out-feed conveyor 9 independently to perform loading and unloading separately.

In the second arrangement shown in Fig. 3 employing three vertically stacked

vacuum chambers 4a, 4b, 4c, a possible cyclical sequence of operation is: to load and unload vacuum chamber 4a; to commence vacuum sealing operation in the lower vacuum chamber 4a and simultaneously to load and unload the middle vacuum chamber 4b; to commence the vacuum sealing operation in the middle vacuum chamber 4b and simultaneously to load and unload the vacuum chamber 4c; to commence the vacuum sealing operation in the upper vacuum chamber 4c and simultaneously to load and unload the lower vacuum chamber 4a once its own vacuum sealing operation has finished.

In the third arrangement shown in Fig. 4, by employing three vacuum chambers 4a, 4b, 4c with a pair of in-feed conveyors 8a, 8b and a pair of out-feed conveyors 9a, 9b it is possible to simultaneously (i) operate one in-feed conveyor and out-feed conveyor (ii) load and unload product packages 2 from one vacuum chamber 4 and (iii) operate the other in-feed conveyor to fill it with new unsealed product packages 2 and the other out-feed conveyor to empty it of sealed product packages 2. This saves time in the operation cycle as compared to arrangements having a single in-feed conveyor 8 and a single out-feed conveyor 9.

The fourth arrangement illustrated in Fig. 5 has two separated pairs of vacuum chambers 4a, 4b and 4c, 4d and a pair of in-feed conveyors 8a, 8b and a pair of out-feed conveyors 9a, 9b having a relative vertical spacing equal to the vertical spacing between the vacuum chambers of each pair 4a, 4b and 4c, 4d.

In each arrangement, at least some of the vacuum chambers 4 have a regular spacing and the in-feed and out-feed conveyors 8, 9 have a relative spacing equal to the spacing between the vacuum chambers 4, this allowing loading and unloading of respective vacuum chambers 4 simultaneously.

Any arrangement of the vacuum packaging machine 1 with a different number of vacuum chambers may be selected to suit the particular packaging line 13 in which it is employed. Preferably the number of vacuum chambers is sufficient relative to the length of the vacuum sealing operation to allow the machine to handle the maximum rate of product package through-put on the packaging line. Therefore the preferred number and configuration of vacuum chambers depends both on the speed of the line and on the size of the vacuum chambers which is governed by the size of the product packaging.

The spacing between the vacuum chambers need not be vertical. They may instead be horizontally spaced or in a 2 dimensional array.

Fig. 6 illustrates the detailed structure of the vacuum packaging machine 1 illustrated schematically in Figs. 2 to 5, in particular with the arrangement shown in Fig. 4 of three vacuum chambers 4, two in-feed conveyors 8 and two out-feed conveyors 9.

The in-feed conveyors 8a, 8b are mounted on respective supports 16a, 16b which are together shuttled vertically by linkage to an endless belt arrangement 17 driven by a motor 18. Similarly the out-feed conveyors 9a, 9b are also mounted on respective supports 51a, 51b and shuttled vertically together by linkage to an endless belt arrangement 19 driven by a motor 20.

The vacuum chambers 4 each comprise a base 21 which supports the internal chamber conveyor 5 and a cover 22 having circumferential hanging walls 23 which in use form the side walls of the closed vacuum chamber 4. Various elements (not shown) are attached to the cover 22 including vacuum pipes, electrical tables and pneumatic pipes. The cover 22 is fixed to the body 3, whereas the base 21 is arranged to reciprocate vertically to open and close the vacuum chamber 4. This means it is unnecessary to move the elements attached to the cover 22 which enables a simpler design and also speeds up opening and closing. When closed, the base 21 seals against the hanging walls 23 of the cover 22 to maintain the vacuum during vacuumisation. Respective pairs of guiding frames 52 are fixed to the body 3 to guide the vertical movement of each base 21.

As an alternative, it would be possible to open and close the vacuum chamber 4 by providing doors which may be hinged or which may slide perpendicularly to the movement of the product packages 2, for example on opposed trails. However, it is preferable to open and close the vacuum chamber 4 by forming it from at least two parts which are relatively movable vertically, because this allows a simpler machine design, lowers manufacturing costs and simplifies servicing and maintenance operations. This is particularly the case if one part is fixed, such as the cover 22, to which elements such as the vacuum pipes may be fixed, so that the movable part, such as the base 21, has only mechanical elements which are easily moved.

Respective identical drive mechanisms 24 are provided for moving the base 21 of each vacuum chamber 4 to open and close the vacuum chamber 4. The drive mechanisms 24 are provided on the rear side of the body 3. The drive mechanisms 24 for one of the vacuum chambers 4 is illustrated in Fig. 7 in an overlapping view with a vacuum chamber 4 to illustrate the location of the drive mechanism 24 and the linkage to the other parts of the vacuum packaging machine 1. In Figs. 8 to 11, a drive mechanism 24 is shown in isolation for clarity.

The drive mechanism 24 is driven by a pneumatic cylinder 25 between the position shown in Figs. 8 and 9 where the base 21 is lowered and the position shown in Figs. 10 and 11 where the base 21 is raised.

The drive mechanism 24 is supported on a first and second mounting blocks 26, 27 fixed to the body 3 of the vacuum packaging machine 1. The pneumatic cylinder 25 reciprocally drives a rod 28 in and out of the pneumatic cylinder 25. A cap 29 on the end of the rod 28 and the end 30 of the pneumatic cylinder 25 opposite to the rod 28 are both pivotally connected to respective angular levers 31, 32. The angular levers 31, 32 are themselves fixed on an axle 33, 34 rotatably mounted by a bearing to a respective mounting block 26, 27. A respective sector 35, 36 is fixed to each axle 33, 34 so as to rotate with the respective angular lever 31, 32. The sectors 35, 36 engage and drive respective cogs 37, 38 rotatable mounted on a bearing within the respective mounting blocks 26, 27. The cogs 37, 38 are fixed on respective drive axles 39, 40 which protrude from the mounting blocks 26, 27 and mount a respective support lever 41, 42.

Respective tracks 43, 44 are supported by studs 45, 46 fixed by a screw to the end of the respective support levers 41, 42 and positioned to slide along the tracks 43, 44. The tracks 43, 44 are fixed to the underside of the base 21 of the vacuum chamber 4 and together support the base 21.

The operation of the drive mechanism 24 is as follows.

When the base 21 is in its lowered position as illustrated in Figs. 8 and 9, actuation of the pneumatic cylinder 25 causes the pneumatic cylinder 25 and rod 28 to be driven apart. This forces the angular levers 31, 32 to rotate away from each other, towards the position illustrated in Fig. 10. This movement of the angular

levers 31, 32 drives the sectors 35, 36 away from each other which in turns drives the drive cogs 37, 38 to rotate in opposite directions. Thus the support levers 41, 42 connected to the cogs 37, 38 by the support axles 39, 40 are rotated in opposite directions towards one another. This causes the studs 45, 46 to move in an arc towards one another and thereby to reciprocate within the tracks 45, 46 and to raise the tracks 43, 44 which raises the base 21 to the position illustrated in Figs. 10 and 11.

Similarly, actuation of the pneumatic cylinder 25 to retract the rod 28 drives motion of the drive mechanism 24 in the opposite direction to lower the base 21.

In addition, the mounting blocks 26, 27 are provided with respective rotatably mounted arms 48, 49 thereon. The arm 49 of the first mounting block 26 has a reverse gear 50 which engages the axle 33 of the first mounting block 26. The arm 48 of the second mounting block 27 is fixed to and rotates with the angular lever 32 supported by the first mounted block 27. Thus the second arm 49 is rotated in the opposite direction to the axle 33, that is in the same direction as the first arm 48. The arms 48, 49 are linked together by a rod 47 which acts as a linkage to synchronise rotation of the elements of the drive mechanism 24 mounted to the first and second mounting blocks 26, 27. The rod 47 also provides structural rigidity between the mounting blocks 25, 26 to avoid mechanical distortion of the guiding frames 52 provided at the sides of the vacuum chamber 4.

CLAIMS

1. A vacuum packaging machine for performing a vacuum sealing operation on product packages, comprising a vertical stack of vacuum chambers each arranged to receive at least one unsealed product package and operable to perform an independent vacuum sealing operation on the at least one product package.

2. A vacuum packaging machine according to claim 1, further comprising a conveyor arrangement operable to load and unload a selective vacuum chamber with the at least one product package, the machine being operable to operate respective vacuum chambers to perform the vacuum sealing operation while the conveyor arrangement is operated to load and unload another vacuum chamber.

3. A vacuum packaging machine according to claim 2, wherein the machine is operable to operate the conveyor arrangement to load and unload the vacuum chambers in a cyclical sequence and synchronously to operate the respective vacuum chambers to perform the vacuum sealing operation on the at least one product packages after loading.

4. A vacuum packaging machine according to claim 3, wherein the number of vacuum chambers is sufficient relative to the duration of the vacuum sealing operation to allow the conveyor arrangement to operate continuously.

5. A vacuum packaging machine according to any one of claims 2 to 4, wherein the conveyor arrangement includes at least one in-feed conveyor operable to load a selected vacuum chamber with the at least one product package.

6. A vacuum packaging machine according to claim 5, wherein the at least one in-feed conveyor is vertically movable to select the vacuum chamber to be loaded.

7. A vacuum packaging machine according to claim 6, wherein the conveyor arrangement includes a plurality of in-feed conveyors which are vertically movable together to select the vacuum chamber to be loaded.

8. A vacuum packaging machine according to claim 7, wherein the vacuum chambers have a regular spacing and the in-feed conveyors have a relative spacing equal to a the spacing between the vacuum chambers.

9. A vacuum packaging machine according to any one of claims 5 to 8, further comprising an internal conveyor in each vacuum chamber extending from the at least one in-feed conveyor.

10. A vacuum packaging machine according to claim 9, wherein the vacuum chambers each have a sealing bar for sealing the at least one product package extending along the internal conveyor.

11. A vacuum packaging machine according to any one of claims 5 to 10, wherein the conveyor arrangement includes at least one out-feed conveyor operable to unload a selected vacuum chamber with the at least one product package.

12. A vacuum packaging machine according to claim 11, wherein the at least one out-feed conveyor is vertically movable to select the vacuum chamber to be unloaded.

13. A vacuum packaging machine according to claim 12, wherein the conveyor arrangement includes a plurality of out-feed conveyors which are vertically movable together to select the vacuum chamber to be unloaded.

14. A vacuum packaging machine according to claim 13, wherein the vacuum chambers have a regular spacing and the out-feed conveyors have a relative

spacing equal to the spacing between the vacuum chambers.

15. A vacuum packaging machine according to claim 13 or 14, wherein the out-feed conveyors have a modular construction allowing out-feed conveyors to be added and removed.

16. A vacuum packaging machine according to claim 7 or any claim appendant to claim 7, wherein the in-feed conveyors have a modular construction allowing in-feed conveyors to be added and removed.

17. A vacuum packaging machine according to any one of the preceding claims, wherein the vacuum chambers have a modular construction allowing vacuum chambers to be added to and removed from the vertical stack.

18. A vacuum packaging machine according to any one of claims 2 to 17, wherein the plurality of vacuum chambers are movable together relative to the conveyor arrangement to select the vacuum chamber to be loaded and unloaded.

19. A vacuum packaging machine according to any one of the preceding claims, wherein the vacuum chambers each have a sealing bar arranged along a side of the respective vacuum chamber for sealing the at least one product packages.

20. A vacuum packaging machine according to any one of the preceding claims, wherein each vacuum chamber comprises at least two parts which are relatively vertically movable to open and close the vacuum chamber.

21. A vacuum packaging machine according to claim 20, wherein each vacuum chamber comprises a base and a cover disposed vertically above the base, wherein the cover is fixed and the base is vertically movable to open and close the vacuum chamber.

Fig.1.

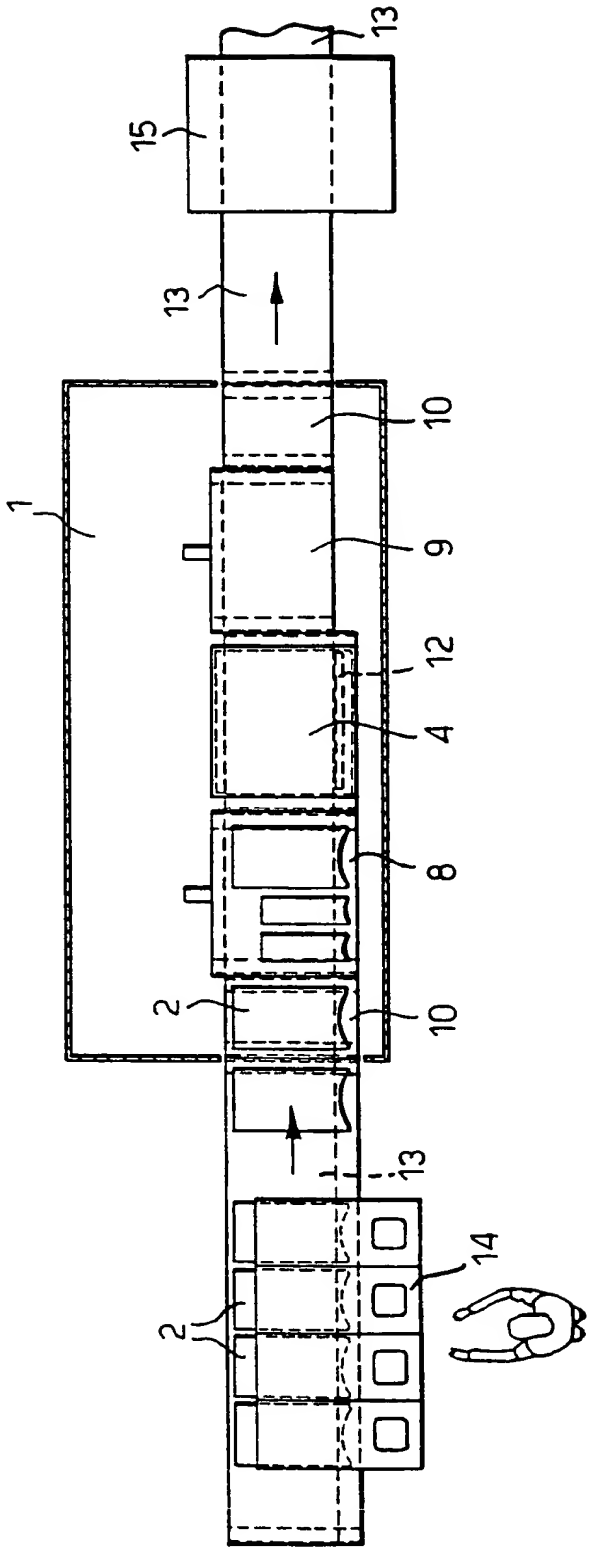


Fig.2.

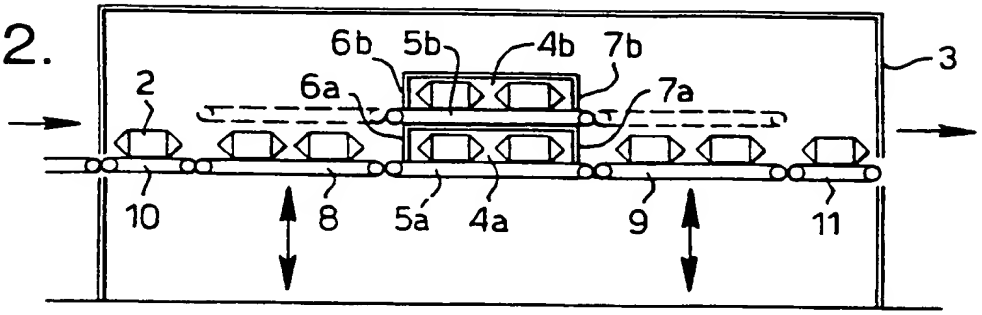


Fig.3.

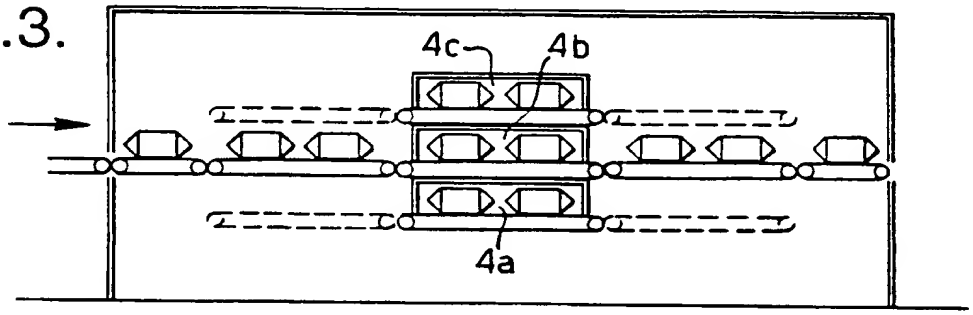


Fig.4.

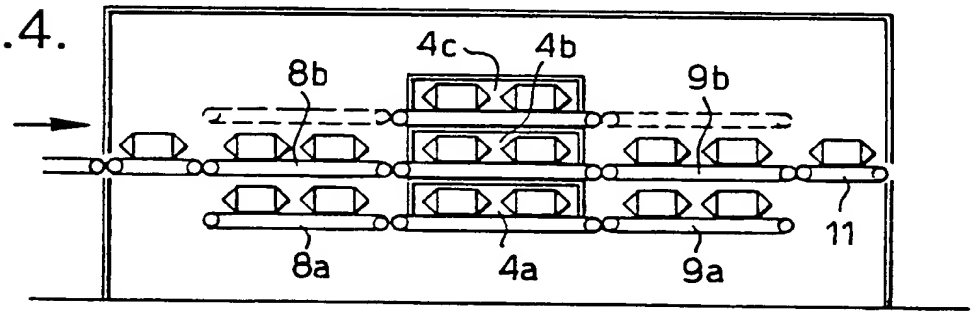


Fig.5.

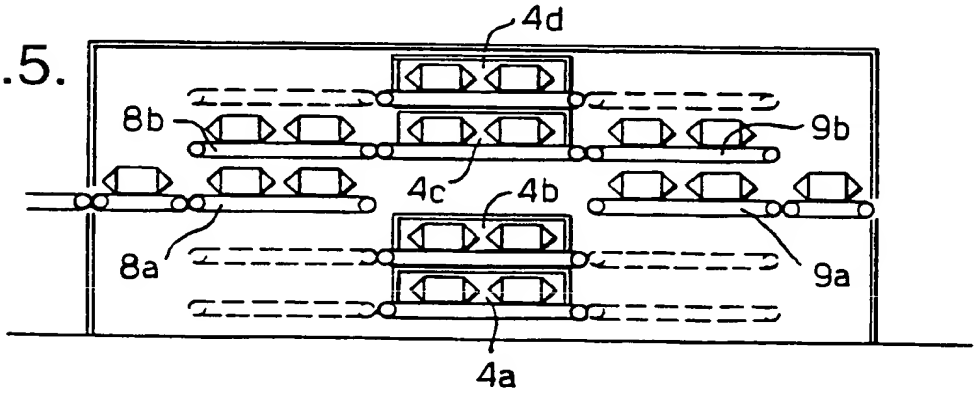
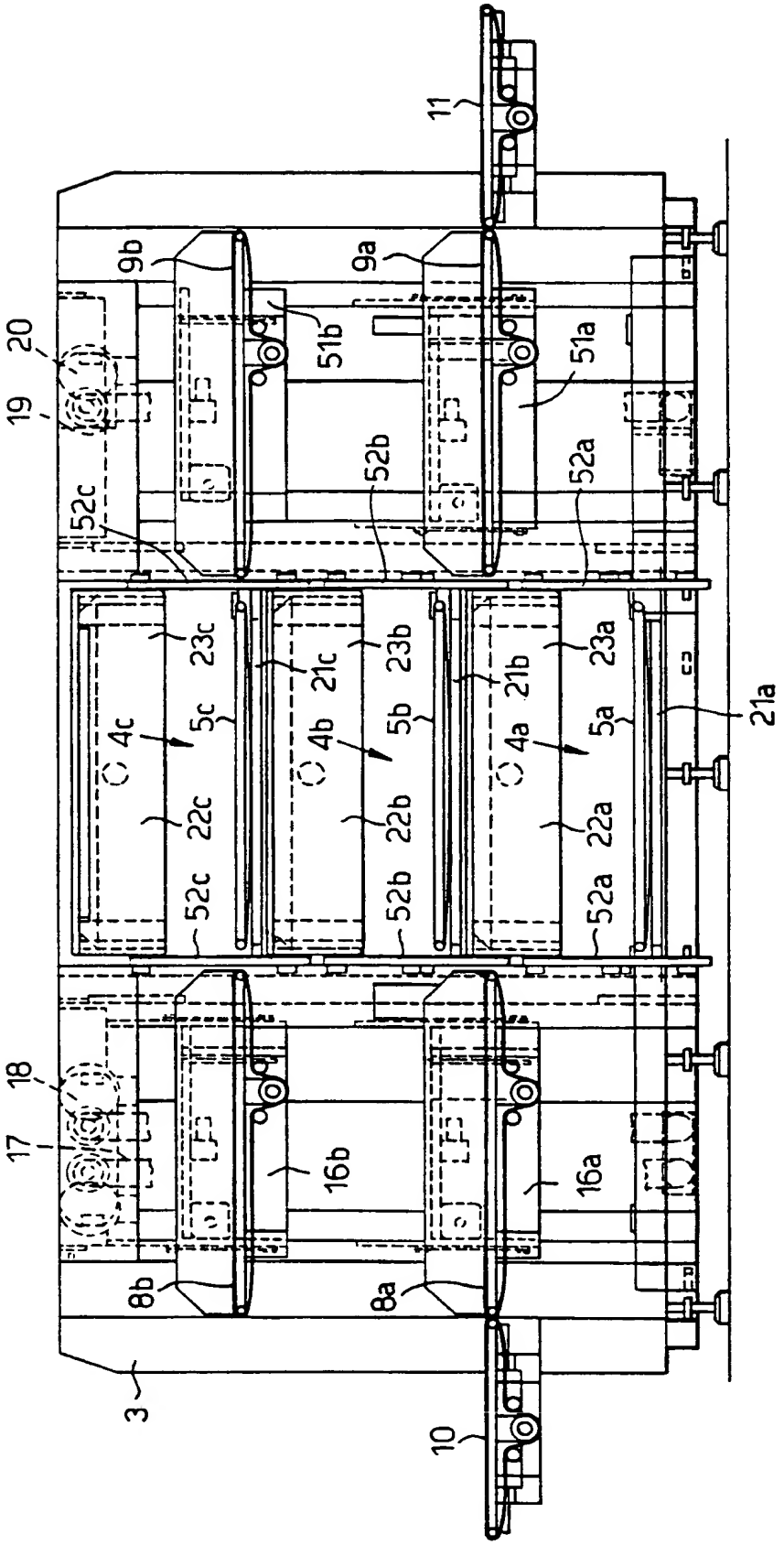


Fig.6.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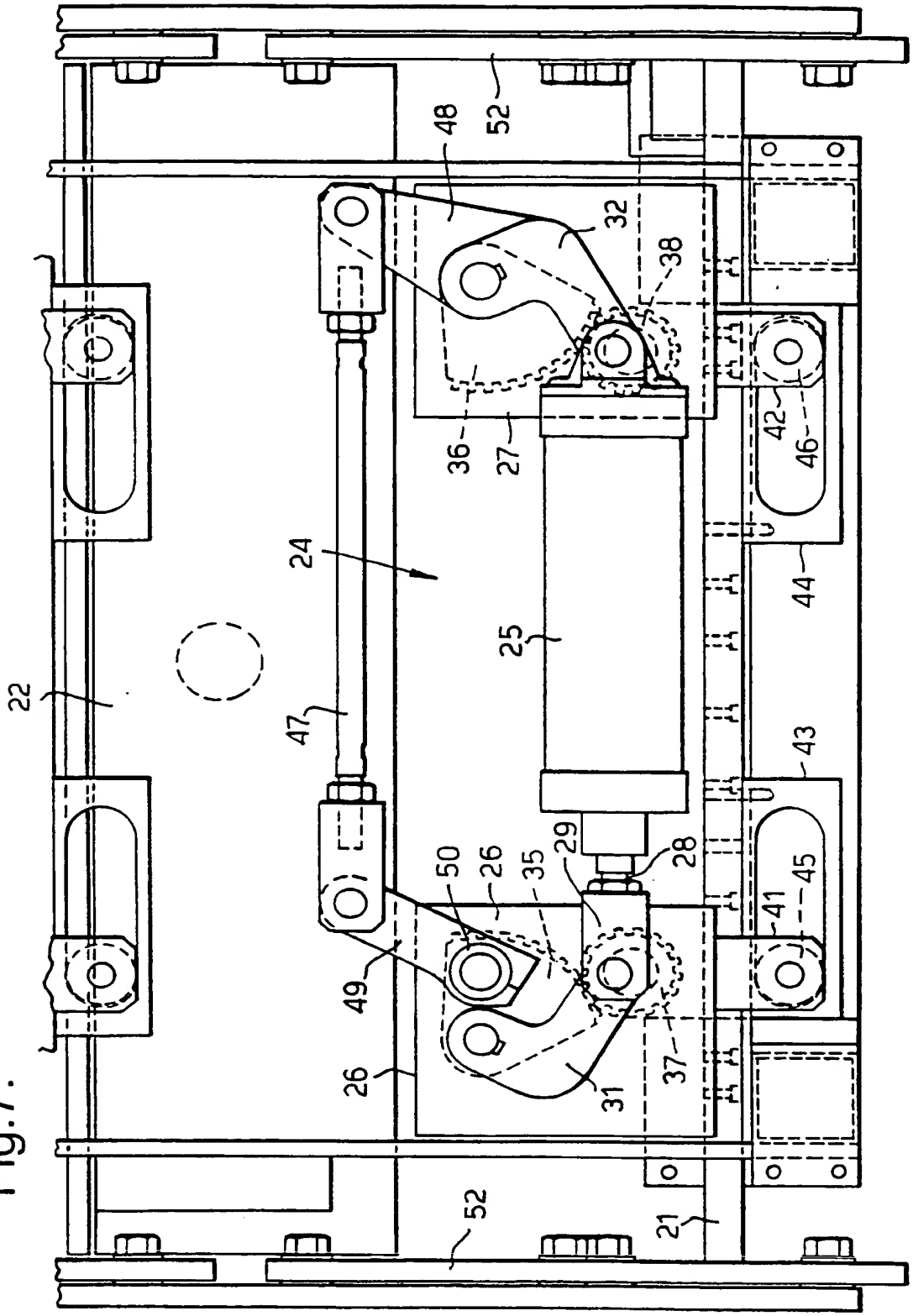
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Fig.7.

Fig.8.

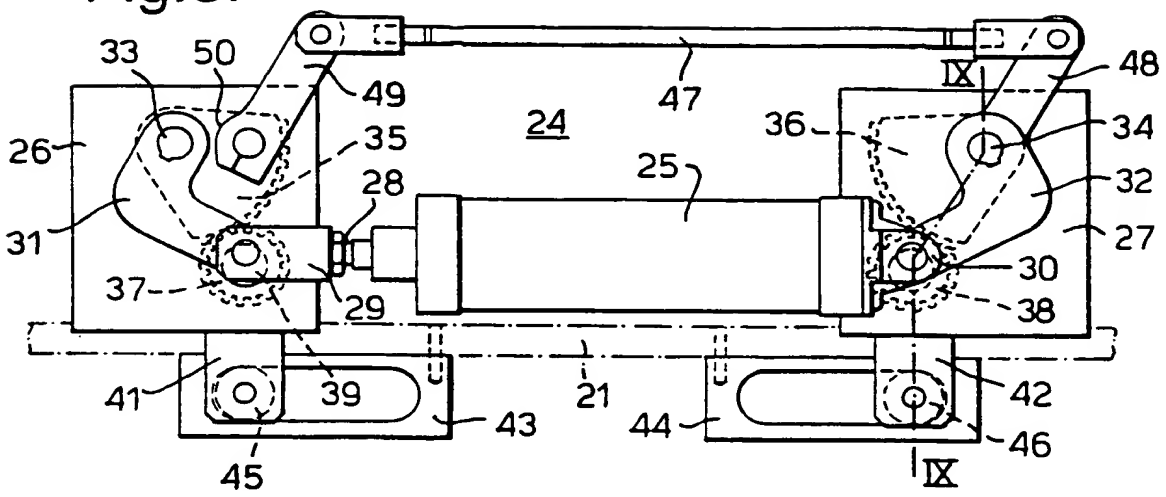


Fig.9.

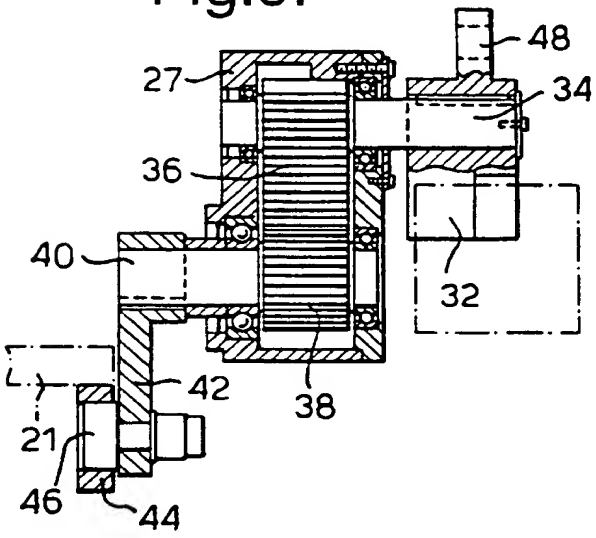


Fig.10.

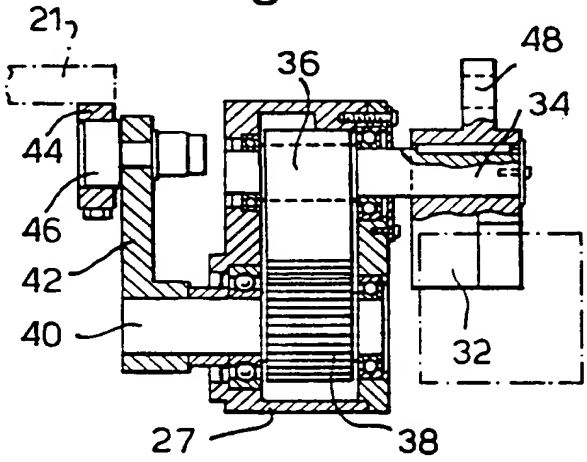
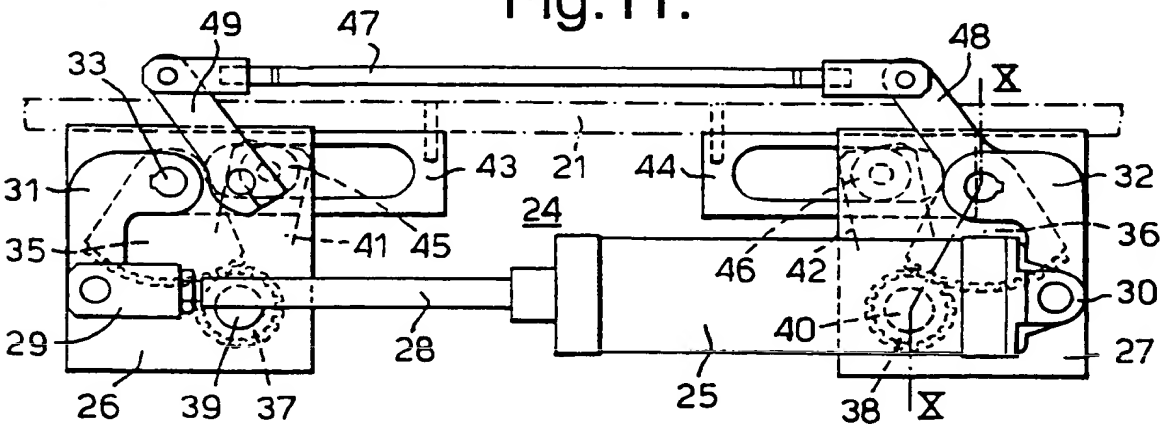


Fig.11.



INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 99/08131

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65B31/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65B B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	WO 98 12111 A (CAPPI ANGELO ;RIMONDI RENATO (IT); AWAX PROGETTAZIONE (IT)) 26 March 1998 (1998-03-26) figures 3-5	1,2,5, 11,18
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Date of the actual completion of the international search	Date of mailing of the international search report
4 May 2000	12/05/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Béraud, F

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Information on patent family members

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WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
B65B 31/02

A2

(11) International Publication Number: WO 00/27706

(43) International Publication Date: 18 May 2000 (18.05.00)

(21) International Application Number: PCT/EP99/08131

(22) International Filing Date: 27 October 1999 (27.10.99)

(30) Priority Data:
98308823.8 28 October 1998 (28.10.98) EP

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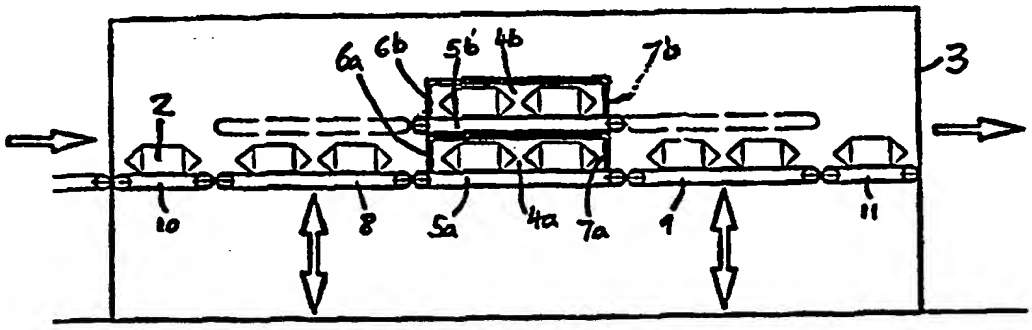
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: VACUUM PACKAGING MACHINE



(57) Abstract

A vacuum packaging machine for performing a vacuum sealing operation on product packages, comprises a vertical stack of vacuum chambers (4) which each manage to receive at least one unsealed product package (2) and are operable to perform an independent vacuum sealing operation on the at least one product package (2). A conveyor arrangement (8, 9) is operable to load and unload a selected vacuum chamber (4) with the at least one product package, and the machine is arranged to operate the respective vacuum chambers (4) to perform the vacuum sealing operation while the conveyor arrangement is operated to load and unload another vacuum chamber (4). The conveyor arrangement loads and unloads the vacuum chambers in sequence, and the vacuum chambers are synchronously operated to perform the vacuum sealing operation to allow the conveyor arrangement to operate continuously. The conveyor arrangement comprises at least one in-feed conveyor (8) and at least one out-feed conveyor (9) which are independently movable to select the vacuum chamber to be loaded and unloaded. There may be a plurality of in-feed conveyors (8) and a plurality of out-feed conveyors (9). The vacuum chambers each have a sealing bar arranged along one side for sealing the product packages (2).

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VACUUM PACKAGING MACHINE

The present invention relates to a vacuum packaging machine for performing a vacuum sealing operation on product packages.

Vacuum packaging machines of a known type comprise a vacuum chamber arranged to receive at least one unsealed product package and operable to perform a vacuum sealing operation on the at least one product package. Typically the product packages are products such as food stuff arranged in a bag formed by a heat-shrinkable film. After loading and closing the vacuum chamber, the vacuum sealing operation normally comprises vacuumisation, sealing the mouth of the vacuumised bags, and reintroducing air into the chamber. Then the chamber is opened and the vacuum chamber is unloaded. The product packages may then be conveyed to a heat-shrinking unit, typically a hot water tunnel or a dip tank.

The vacuumisation step typically takes at least 20-30 seconds which is mostly wasted time in the overall packaging process. During this time, the only step which can be taken is to prepare the next product packages for loading into the vacuum chamber, for example by conveying them onto an in-feed conveyor. Accordingly, the vacuum packing machine causes a bottle-neck in the overall packaging process.

According to the present invention, there is provided a vacuum packaging machine for performing a vacuum sealing operation on product packages, comprising a vertical stack of vacuum chambers each arranged to receive at least one unsealed product package and operable to perform an independent vacuum sealing operation on the at least one product package.

The provision of more than one vacuum chamber in the vacuum packaging machine allows respective vacuum chambers to perform a vacuum sealing operation while another vacuum chamber is being loaded and/or unloaded. Therefore, the machine may minimise the wasted time in the vacuum packaging process. Consequently, the present invention can increase through-put and increase productivity of a packaging line including the machine. Furthermore, by arranging the vacuum chambers in a vertical stack, this increase in productivity may be

achieved without significantly increasing the floor area of the vacuum packaging machine. The extra vacuum chambers only increase the height of the machine. This is a significant advantage in manufacturing plants where increasing the footprint of the vacuum packaging machine would create real problems but where there is normally space to increase the height of the machine.

Preferably, the vacuum packaging machine further comprises a conveyor arrangement operable to load and unload a selective vacuum chamber with the at least one product package, the machine being operable to operate the respective vacuum chambers to perform the vacuum sealing operation while the conveyor arrangement is operated to load and unload another vacuum chamber.

The conveyor arrangement can automatically load and unload selected vacuum chambers. Operation of one or more of the vacuum chambers while the conveyor arrangement is loading and unloading another vacuum chamber reduces the amount of time wasted, thereby increasing through-put and increasing productivity of a packaging line including the machine.

Preferably, the machine is operable to operate the conveyor arrangement to load and unload the vacuum chambers in a cyclical sequence and synchronously to operate the respective vacuum chambers to perform the vacuum sealing operation on the at least one product packages after loading.

Such a cyclical operation allows the machine to be utilised in an automatic continuous packaging line. It is desirable that the number of vacuum chambers is sufficient relative to the duration of the vacuum sealing operation to allow the conveyor arrangement to operate continuously because this minimises the amount of wasted time. Time wastage can be reduced further by designing the conveyor arrangement to load and unload the vacuum chambers more rapidly. The described embodiments include particularly suitable conveyor arrangements as follows.

Preferably, the conveyor arrangement includes at least one in-feed conveyor operable to load a selected vacuum chamber with the at least one product package.

Preferably, the conveyor arrangement includes at least one out-feed conveyor operable to unload a selected vacuum chamber with the at least one product package, although as an alternative the in-feed conveyor may be operable in reverse to unload

a selected vacuum chamber.

Provision of separate in-feed and out-feed conveyors allows the loading and unloading to occur simultaneously, preferably with the in-feed and out-feed conveyors being linked by an internal conveyor in each vacuum chamber.

Preferably, the at least one in-feed conveyor and/or the at least one out-feed conveyor are vertically movable to select the vacuum chamber to be loaded. Additionally or alternatively, the plurality of vacuum chambers are movable together relative to the conveyor arrangement to select the vacuum chamber to be loaded and unloaded.

The conveyor arrangement may include a plurality of in-feed conveyors and/or out-feed conveyors which are movable together. In this case, the vacuum chambers are preferably have a regular spacing and the in-feed conveyors and/or out-feed conveyors have a relative spacing equal to the spacing between the vacuum chambers. This allows more than one vacuum chamber to be loaded and/or unloaded simultaneously.

Desirably, the vacuum chambers each have a sealing bar arranged along a side of the respective vacuum chamber for sealing the at least one product packages, preferably extending along the internal conveyor. This prevents the sealing bar from hindering loading and unloading improves the automatic operation of the machine because the product packages always have the same orientation.

Advantageously, the vacuum chambers and/or the in-feed conveyors and/or the out-feed conveyors have a modular construction. This allows the modular parts to be added and removed in order to assemble the machine with a variable number of the parts in order to provide a productivity and cost appropriate to the particular packaging line in which the machine is used. Thus, this modular construction increases the flexibility of the machine and allows it to be used in different packaging lines. This flexibility is particularly advantageous with the vacuum chambers being arranged in a vertical stack because the productivity of the machine may be altered whilst covering the same floor space within the manufacturing plant because only the height of the machine is altered.

Advantageously, each vacuum chamber comprises at least two parts which

are relatively vertically movable to open and close the vacuum chamber. This construction for the vacuum chambers is advantageous because it allows for a simple machine design, lower manufacturing costs and simple servicing and maintenance operations as compared to a vacuum chambers which are open and closed by the provision of doors.

In order that the present invention may be better understood, the following description of preferred embodiments is given by way of non-limitative example with reference to the accompanying drawings in which:

Fig. 1 is a top plan view of a packaging line including a vacuum packaging machine which is a first embodiment of the present invention;

Fig. 2 is a schematic sectional side view of a first arrangement for a vacuum packaging machine according to the present invention;

Fig. 3 is a schematic sectional side view of a second arrangement for a vacuum packaging machine according to the present invention;

Fig. 4 is a schematic sectional side view of a third arrangement for a vacuum packaging machine according to the present invention;

Fig. 5 is a schematic sectional side view of a fourth arrangement for a vacuum packaging machine according to the present invention;

Fig. 6 is a detailed side view of a vacuum packaging machine according to the present invention;

Fig. 7 is a partial enlarged view of the vacuum packaging machine shown in Fig. 6 and showing a vacuum chamber and a drive mechanism for opening and closing a vacuum chamber in an overlapping view;

Fig. 8 is a side view of the drive mechanism of Fig. 7 in isolation in a first position;

Fig. 9 is a cross-sectional view taken along line IX-IX of the drive mechanism in the first position of Fig. 7;

Fig. 10 is a side view of the drive mechanism in the second position; and

Fig. 11 is a cross-sectional view taken along line XI-XI of the drive mechanism in the second position of Fig. 10.

Fig. 1 is a top plan view of a vacuum packaging machine 1 which is an

embodiment of the present invention arranged in a packaging line 13 constituted by a series of conveyors. At a bagging section 14, products are bagged in heat-shrinkable film bags, or alternatively in small pouches made from thin films, and arranged on line 13 as product packages 2. A vacuum packaging machine 1 performs a vacuum sealing operation on the product packages 2 which are then output back onto the packaging lines 13 which conveys them through a shrink tunnel 15 to perform a heat-shrinking operation. The product packages 2 move continuously through the shrink tunnel 15 which is advantageous over heat-shrinking of products in batches where it is difficult to obtain uniform shrinking of the packaging around each product as a result of contact or proximity between the various product packages 2.

Figs. 2 to 5 are sectional side views of various arrangements for the vacuum packaging machine 1. Figs. 2 to 5 are schematic for ease of understanding of the overall arrangement and operation. Details of the structure of the vacuum packaging machine are given subsequently.

The vacuum packaging machine 1 has a body 3 supporting a plurality of vertically stacked vacuum chambers 4. As can be seen in Fig. 1, since the vacuum chambers 4 are stacked vertically, they only occupy the same floor space as a single vacuum chamber. Except as described below, each vacuum chamber 4 is in itself of conventional construction and performs a vacuum sealing operation in a conventional manner.

Each vacuum chamber 4 has a modular construction allowing vacuum chambers to be added or removed from the vacuum packaging machine 1. For example, in the arrangement illustrated in Fig. 2, there are two vacuum chambers 4a, 4b. In the arrangements illustrated in Figs. 3 and 4, an additional vacuum chamber 4c has been added so that there are three vacuum chambers 4a, 4b, 4c. In the arrangement illustrated in Fig. 5, there are four vacuum chambers, 4a, 4b, 4c, 4d.

Each vacuum chambers 4 has an internal chamber conveyor 5 to convey product packages 2 therethrough, and a respective sealing bar 12 arranged along one side of the chamber extending along the corresponding chamber conveyer 5. Provision of a sealing bar 12 on the side of the chamber conveyor 5 facilitates automatic feeding and loading is made easier by the bags being orientated in the

same direction.

Each chamber has a respective entrance 6 and exit 7. Opening and closing of the vacuum chambers is described in more detail subsequently.

At least one in-feed conveyor 8 and at least one out-feed conveyor 9 are provided on opposite sides of the vacuum chambers 4 facing entrances 6 and exits 7. The in-feed and out-feed conveyors 8, 9 are independently vertically moveable, for example between a lower position shown in bold outline in Fig. 2 for loading and unloading the lower vacuum chamber 4a and a higher position shown in dotted outline in Fig. 2 for loading and unloading the upper vacuum chamber 4b.

The in-feed conveyors 8 and the out-feed conveyors 9 have a modular construction allowing additional conveyors to be added or removed. In the arrangements illustrated in Figs. 2 and 3 only a single in-feed conveyor 8 and an out-feed conveyor 9 are used. In the arrangements illustrated in Figs. 4 and 5, conveyors have been added so that there are a pair of in-feed conveyors 8a, 8b and a pair of out-feed conveyors 9a, 9b. Where plural in-feed or out-feed conveyors 8, 9 are provided, these are arranged in a vertical stack with the in-feed conveyors 8 being moveable together as a unit and the out-feed conveyors being moveable together as a unit.

A fixed input conveyor 10 is provided to receive unsealed product packages 2 into the machine 1 from station 14 along packaging line 13 and supply them to the in-feed conveyor 8. Another fixed output conveyor 11 receives sealed packages 9 from the out-feed conveyor 9 and outputs them along line 13.

In an alternative construction, the at least one in-feed and out-feed conveyors 8, 9 are fixed in the position shown in bold in Fig. 2 and the vacuum chambers 4 are movable together vertically between upper position, as shown in Fig. 2, for loading and unloading the lower vacuum chamber 4a and a lower position in which the vacuum chamber 4b is aligned with in-feed and out-feed conveyors 8, 9 for loading and unloading.

All the conveyors 5, 8, 9, 10, 11 are indexed, that is they are driven to execute an indexing motion.

The vacuum chambers 4 are illustrated as accommodating two product packages 2, but they may be dimensioned to accommodate any number of product

packages 2.

The vacuum packaging machine 1 is operated in a continuous cycle controlled by an electronic control unit (not shown), although manual control is an alternative possibility. Loading and unloading of the vacuum chambers 4 is performed in a cyclical sequence and the vacuum chambers are synchronously operated to perform a vacuum sealing operation on the loaded product packages 2, including vacuumisation and sealing of the product packages 2 using the sealing bar 12. In general the provision of plural vacuum chambers 4 allows the vacuum sealing operation to be performed in one vacuum chamber 4 whilst another vacuum chamber 4 is being loaded and unloaded.

Normally, the at least one in-feed conveyor 8 and out-feed conveyor 9 are synchronously moved vertically. An opposed in-feed conveyor 8 and out-feed conveyor 9 adjacent the fixed conveyors 10, 11 are operated synchronously to receive product packages 2 from the fixed input conveyor 10 and to supply sealed product packages to the fixed output conveyor 11, and are then moved adjacent one of the vacuum chambers 4. Similarly, an opposed in-feed conveyor 8 and out-feed conveyor 9 adjacent a given vacuum chamber 4 are operated synchronously to load the given vacuum chamber 4 with unsealed product packages 2 and simultaneously to unload the same vacuum chamber 4 with the sealed product packages 2.

The advantage of providing plural in-feed and out-feed conveyors 8, 9 (as in the arrangements illustrated in Figs. 4 and 5) is that a given vacuum chamber 4 may be loaded and unloaded using a first in-feed conveyor 8 and out-feed conveyor 9 simultaneously with supply to and from a second in-feed conveyor 8 and out-feed conveyor 9 from and to the fixed conveyors 10 and 11.

The precise order of operation of the elements of the vacuum packaging machine 1 in a cycle depends on the number of vacuum chambers 4, in-feed conveyors 8 and out-feed conveyors 9 arranged in the vacuum packaging machine 1. A possible cycle for the arrangement of the vacuum packaging machine 1 illustrated in Fig 2 is as follows and is illustrative of the cycle for other arrangements.

As an arbitrary starting point within the cycle, we can take the point at which the vacuum sealing operation in the lower vacuum chamber 4a has just finished. At this time, the vacuum sealing operation in the upper vacuum chamber 4b is

underway. The lower vacuum chamber 4a is opened. Next, the fixed conveyors 10,11, the in-feed and out-feed conveyors 8, 9 and the lower chamber conveyor 5a are simultaneously operated (i) to load lower vacuum chamber 4a with new unsealed product packages from the in-feed conveyor 8, (ii) to unload the lower vacuum chamber 4a onto the out-feed conveyor 9, and (iii) to supply new unsealed product packages 2 onto the in-feed conveyor 8. Exact synchronisation is preferable but some degree of overlap may be desirable. The lower vacuum chamber 4a is then closed for commencement of the vacuum sealing operation, that is vacuumisation of the chamber 4a and sealing of the product packages 2 by sealing bar 12.

During the vacuum sealing operation in the lower vacuum chamber 4a, loading and unloading of the upper vacuum chamber 5 is performed. The out-feed conveyor 9 is operated briefly to clear sealed products off it. Then the in-feed and out-feed conveyors 8, 9 are raised to the upper vacuum chamber 4b and when the vacuum sealing operation in the upper vacuum chamber 4b has finished, the upper vacuum chamber 46 is opened. Simultaneous operation of the in-feed and out-feed conveyors 8, 9 and the upper chamber conveyor 5b loads and unloads the upper vacuum chamber 4b.

Subsequently, the upper vacuum chamber 4b is closed and the vacuum sealing operation in the upper vacuum chamber 4b is commenced. At the same time, the in-feed and out-feed conveyors 8, 9 are operated to load and unload the lower vacuum chamber 4a. That is to say, the in-feed and out-feed conveyors 8, 9 are lowered and then the in-feed conveyor 8 is operated simultaneously with the fixed conveyor 10 to fill the in-feed conveyor with new product packages 2 from in-feed conveyor 8 while the sealed packages move onto the out-feed conveyor 9.

The cycle then repeats.

Various modifications to the cycle are possible. For example, instead of simultaneously loading and unloading a vacuum chamber 4 by operating the in-feed and out-feed conveyor 8, a chamber conveyor 5 and out-feed conveyor 9 together, it is possible to operate in-feed conveyor 8 and out-feed conveyor 9 independently to perform loading and unloading separately.

In the second arrangement shown in Fig. 3 employing three vertically stacked

vacuum chambers 4a, 4b, 4c, a possible cyclical sequence of operation is: to load and unload vacuum chamber 4a; to commence vacuum sealing operation in the lower vacuum chamber 4a and simultaneously to load and unload the middle vacuum chamber 4b; to commence the vacuum sealing operation in the middle vacuum chamber 4b and simultaneously to load and unload the vacuum chamber 4c; to commence the vacuum sealing operation in the upper vacuum chamber 4c and simultaneously to load and unload the lower vacuum chamber 4a once its own vacuum sealing operation has finished.

In the third arrangement shown in Fig. 4, by employing three vacuum chambers 4a, 4b, 4c with a pair of in-feed conveyors 8a, 8b and a pair of out-feed conveyors 9a, 9b it is possible to simultaneously (i) operate one in-feed conveyor and out-feed conveyor (ii) load and unload product packages 2 from one vacuum chamber 4 and (iii) operate the other in-feed conveyor to fill it with new unsealed product packages 2 and the other out-feed conveyor to empty it of sealed product packages 2. This saves time in the operation cycle as compared to arrangements having a single in-feed conveyor 8 and a single out-feed conveyor 9.

The fourth arrangement illustrated in Fig. 5 has two separated pairs of vacuum chambers 4a, 4b and 4c, 4d and a pair of in-feed conveyors 8a, 8b and a pair of out-feed conveyors 9a, 9b having a relative vertical spacing equal to the vertical spacing between the vacuum chambers of each pair 4a, 4b and 4c, 4d.

In each arrangement, at least some of the vacuum chambers 4 have a regular spacing and the in-feed and out-feed conveyors 8, 9 have a relative spacing equal to the spacing between the vacuum chambers 4, this allowing loading and unloading of respective vacuum chambers 4 simultaneously.

Any arrangement of the vacuum packaging machine 1 with a different number of vacuum chambers may be selected to suit the particular packaging line 13 in which it is employed. Preferably the number of vacuum chambers is sufficient relative to the length of the vacuum sealing operation to allow the machine to handle the maximum rate of product package through-put on the packaging line. Therefore the preferred number and configuration of vacuum chambers depends both on the speed of the line and on the size of the vacuum chambers which is governed by the size of the product packaging.

The spacing between the vacuum chambers need not be vertical. They may instead be horizontally spaced or in a 2 dimensional array.

Fig. 6 illustrates the detailed structure of the vacuum packaging machine 1 illustrated schematically in Figs. 2 to 5, in particular with the arrangement shown in Fig. 4 of three vacuum chambers 4, two in-feed conveyors 8 and two out-feed conveyors 9.

The in-feed conveyors 8a, 8b are mounted on respective supports 16a, 16b which are together shuttled vertically by linkage to an endless belt arrangement 17 driven by a motor 18. Similarly the out-feed conveyors 9a, 9b are also mounted on respective supports 51a, 51b and shuttled vertically together by linkage to an endless belt arrangement 19 driven by a motor 20.

The vacuum chambers 4 each comprise a base 21 which supports the internal chamber conveyor 5 and a cover 22 having circumferential hanging walls 23 which in use form the side walls of the closed vacuum chamber 4. Various elements (not shown) are attached to the cover 22 including vacuum pipes, electrical tables and pneumatic pipes. The cover 22 is fixed to the body 3, whereas the base 21 is arranged to reciprocate vertically to open and close the vacuum chamber 4. This means it is unnecessary to move the elements attached to the cover 22 which enables a simpler design and also speeds up opening and closing. When closed, the base 21 seals against the hanging walls 23 of the cover 22 to maintain the vacuum during vacuumisation. Respective pairs of guiding frames 52 are fixed to the body 3 to guide the vertical movement of each base 21.

As an alternative, it would be possible to open and close the vacuum chamber 4 by providing doors which may be hinged or which may slide perpendicularly to the movement of the product packages 2, for example on opposed trails. However, it is preferable to open and close the vacuum chamber 4 by forming it from at least two parts which are relatively movable vertically, because this allows a simpler machine design, lowers manufacturing costs and simplifies servicing and maintenance operations. This is particularly the case if one part is fixed, such as the cover 22, to which elements such as the vacuum pipes may be fixed, so that the movable part, such as the base 21, has only mechanical elements which are easily moved.

Respective identical drive mechanisms 24 are provided for moving the base 21 of each vacuum chamber 4 to open and close the vacuum chamber 4. The drive mechanisms 24 are provided on the rear side of the body 3. The drive mechanisms 24 for one of the vacuum chambers 4 is illustrated in Fig. 7 in an overlapping view with a vacuum chamber 4 to illustrate the location of the drive mechanism 24 and the linkage to the other parts of the vacuum packaging machine 1. In Figs. 8 to 11, a drive mechanism 24 is shown in isolation for clarity.

The drive mechanism 24 is driven by a pneumatic cylinder 25 between the position shown in Figs. 8 and 9 where the base 21 is lowered and the position shown in Figs. 10 and 11 where the base 21 is raised.

The drive mechanism 24 is supported on a first and second mounting blocks 26, 27 fixed to the body 3 of the vacuum packaging machine 1. The pneumatic cylinder 25 reciprocally drives a rod 28 in and out of the pneumatic cylinder 25. A cap 29 on the end of the rod 28 and the end 30 of the pneumatic cylinder 25 opposite to the rod 28 are both pivotally connected to respective angular levers 31, 32. The angular levers 31, 32 are themselves fixed on an axle 33, 34 rotatably mounted by a bearing to a respective mounting block 26, 27. A respective sector 35, 36 is fixed to each axle 33, 34 so as to rotate with the respective angular lever 31, 32. The sectors 35, 36 engage and drive respective cogs 37, 38 rotatable mounted on a bearing within the respective mounting blocks 26, 27. The cogs 37, 38 are fixed on respective drive axles 39, 40 which protrude from the mounting blocks 26, 27 and mount a respective support lever 41, 42.

Respective tracks 43, 44 are supported by studs 45, 46 fixed by a screw to the end of the respective support levers 41, 42 and positioned to slide along the tracks 43, 44. The tracks 43, 44 are fixed to the underside of the base 21 of the vacuum chamber 4 and together support the base 21.

The operation of the drive mechanism 24 is as follows.

When the base 21 is in its lowered position as illustrated in Figs. 8 and 9, actuation of the pneumatic cylinder 25 causes the pneumatic cylinder 25 and rod 28 to be driven apart. This forces the angular levers 31, 32 to rotate away from each other, towards the position illustrated in Fig. 10. This movement of the angular

levers 31, 32 drives the sectors 35, 36 away from each other which in turns drives the drive cogs 37, 38 to rotate in opposite directions. Thus the support levers 41, 42 connected to the cogs 37, 38 by the support axles 39, 40 are rotated in opposite directions towards one another. This causes the studs 45, 46 to move in an arc towards one another and thereby to reciprocate within the tracks 45, 46 and to raise the tracks 43, 44 which raises the base 21 to the position illustrated in Figs. 10 and 11.

Similarly, actuation of the pneumatic cylinder 25 to retract the rod 28 drives motion of the drive mechanism 24 in the opposite direction to lower the base 21.

In addition, the mounting blocks 26, 27 are provided with respective rotatably mounted arms 48, 49 thereon. The arm 49 of the first mounting block 26 has a reverse gear 50 which engages the axle 33 of the first mounting block 26. The arm 48 of the second mounting block 27 is fixed to and rotates with the angular lever 32 supported by the first mounted block 27. Thus the second arm 49 is rotated in the opposite direction to the axle 33, that is in the same direction as the first arm 48. The arms 48, 49 are linked together by a rod 47 which acts as a linkage to synchronise rotation of the elements of the drive mechanism 24 mounted to the first and second mounting blocks 26, 27. The rod 47 also provides structural rigidity between the mounting blocks 25, 26 to avoid mechanical distortion of the guiding frames 52 provided at the sides of the vacuum chamber 4.

CLAIMS

1. A vacuum packaging machine for performing a vacuum sealing operation on product packages, comprising a vertical stack of vacuum chambers each arranged to receive at least one unsealed product package and operable to perform an independent vacuum sealing operation on the at least one product package.

2. A vacuum packaging machine according to claim 1, further comprising a conveyor arrangement operable to load and unload a selective vacuum chamber with the at least one product package, the machine being operable to operate respective vacuum chambers to perform the vacuum sealing operation while the conveyor arrangement is operated to load and unload another vacuum chamber.

3. A vacuum packaging machine according to claim 2, wherein the machine is operable to operate the conveyor arrangement to load and unload the vacuum chambers in a cyclical sequence and synchronously to operate the respective vacuum chambers to perform the vacuum sealing operation on the at least one product packages after loading.

4. A vacuum packaging machine according to claim 3, wherein the number of vacuum chambers is sufficient relative to the duration of the vacuum sealing operation to allow the conveyor arrangement to operate continuously.

5. A vacuum packaging machine according to any one of claims 2 to 4, wherein the conveyor arrangement includes at least one in-feed conveyor operable to load a selected vacuum chamber with the at least one product package.

6. A vacuum packaging machine according to claim 5, wherein the at least one in-feed conveyor is vertically movable to select the vacuum chamber to be loaded.

7. A vacuum packaging machine according to claim 6, wherein the conveyor arrangement includes a plurality of in-feed conveyors which are vertically movable together to select the vacuum chamber to be loaded.

8. A vacuum packaging machine according to claim 7, wherein the vacuum chambers have a regular spacing and the in-feed conveyors have a relative spacing equal to a the spacing between the vacuum chambers.

9. A vacuum packaging machine according to any one of claims 5 to 8, further comprising an internal conveyor in each vacuum chamber extending from the at least one in-feed conveyor.

10. A vacuum packaging machine according to claim 9, wherein the vacuum chambers each have a sealing bar for sealing the at least one product package extending along the internal conveyor.

11. A vacuum packaging machine according to any one of claims 5 to 10, wherein the conveyor arrangement includes at least one out-feed conveyor operable to unload a selected vacuum chamber with the at least one product package.

12. A vacuum packaging machine according to claim 11, wherein the at least one out-feed conveyor is vertically movable to select the vacuum chamber to be unloaded.

13. A vacuum packaging machine according to claim 12, wherein the conveyor arrangement includes a plurality of out-feed conveyors which are vertically movable together to select the vacuum chamber to be unloaded.

14. A vacuum packaging machine according to claim 13, wherein the vacuum chambers have a regular spacing and the out-feed conveyors have a relative

spacing equal to the spacing between the vacuum chambers.

15. A vacuum packaging machine according to claim 13 or 14, wherein the out-feed conveyors have a modular construction allowing out-feed conveyors to be added and removed.

16. A vacuum packaging machine according to claim 7 or any claim appendant to claim 7, wherein the in-feed conveyors have a modular construction allowing in-feed conveyors to be added and removed.

17. A vacuum packaging machine according to any one of the preceding claims, wherein the vacuum chambers have a modular construction allowing vacuum chambers to be added to and removed from the vertical stack.

18. A vacuum packaging machine according to any one of claims 2 to 17, wherein the plurality of vacuum chambers are movable together relative to the conveyor arrangement to select the vacuum chamber to be loaded and unloaded.

19. A vacuum packaging machine according to any one of the preceding claims, wherein the vacuum chambers each have a sealing bar arranged along a side of the respective vacuum chamber for sealing the at least one product packages.

20. A vacuum packaging machine according to any one of the preceding claims, wherein each vacuum chamber comprises at least two parts which are relatively vertically movable to open and close the vacuum chamber.

21. A vacuum packaging machine according to claim 20, wherein each vacuum chamber comprises a base and a cover disposed vertically above the base, wherein the cover is fixed and the base is vertically movable to open and close the vacuum chamber.

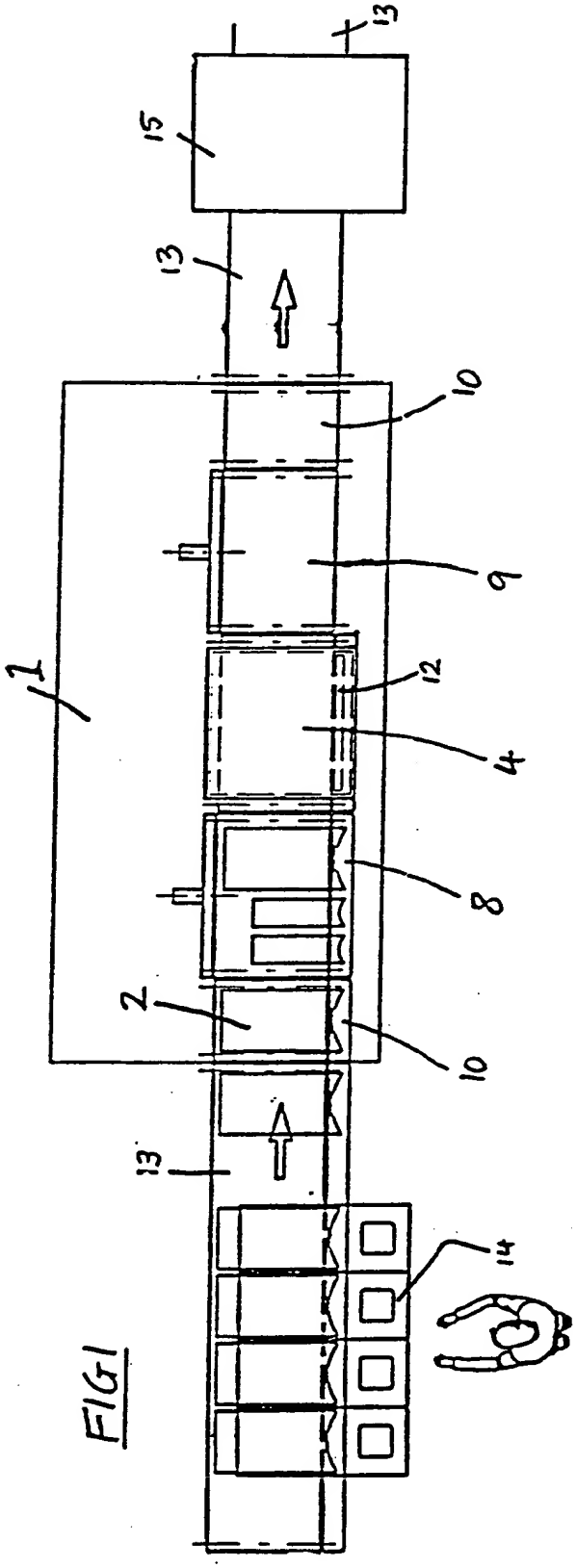


FIG1

FIG2

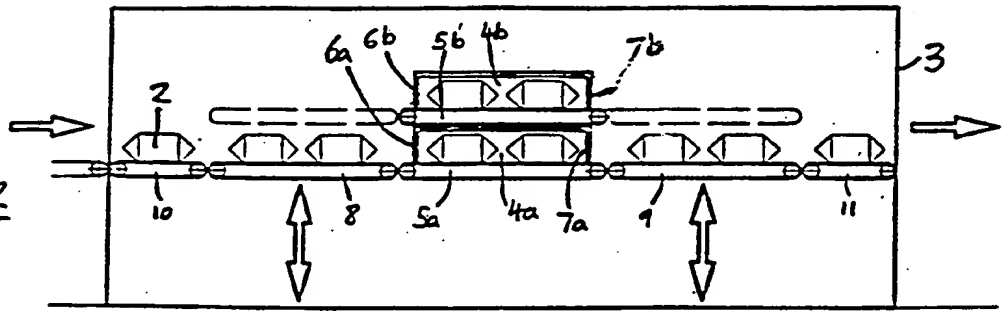


FIG3

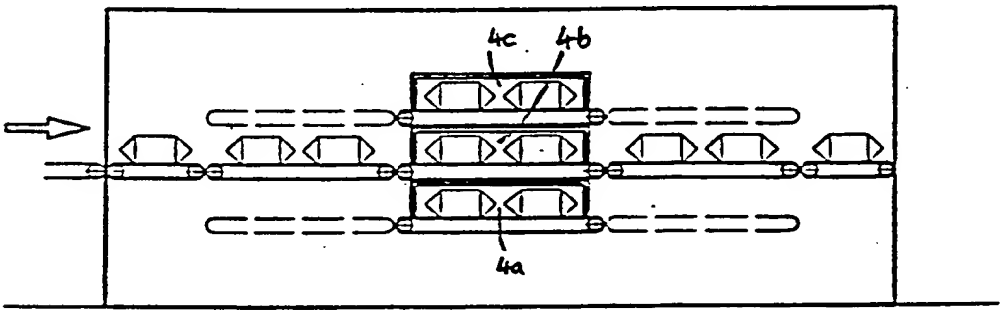


FIG 4

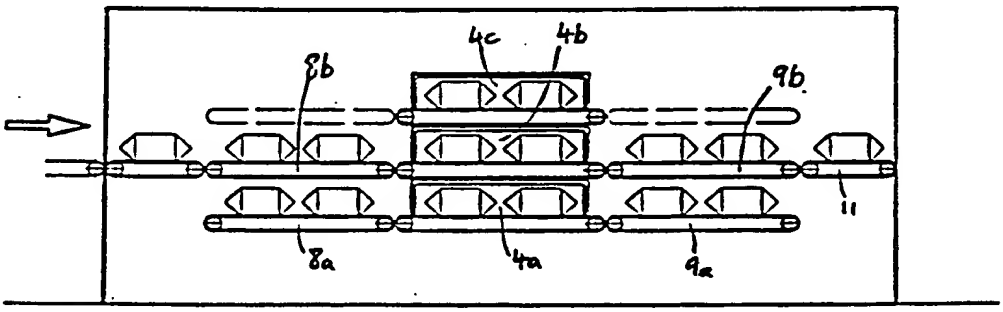
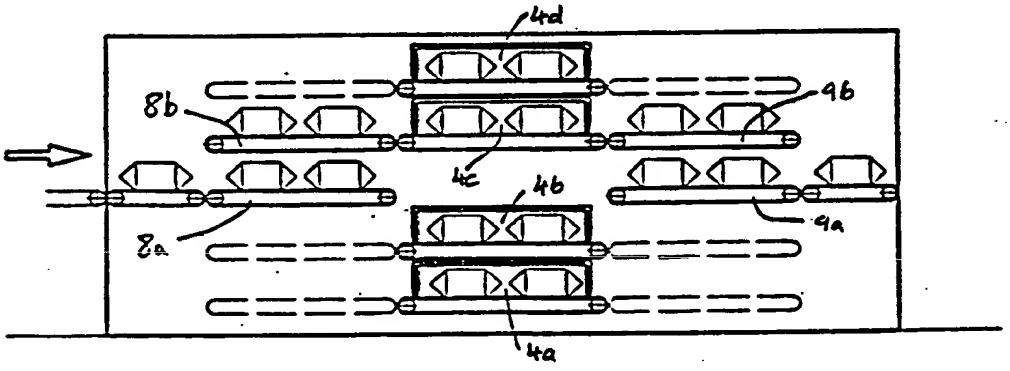
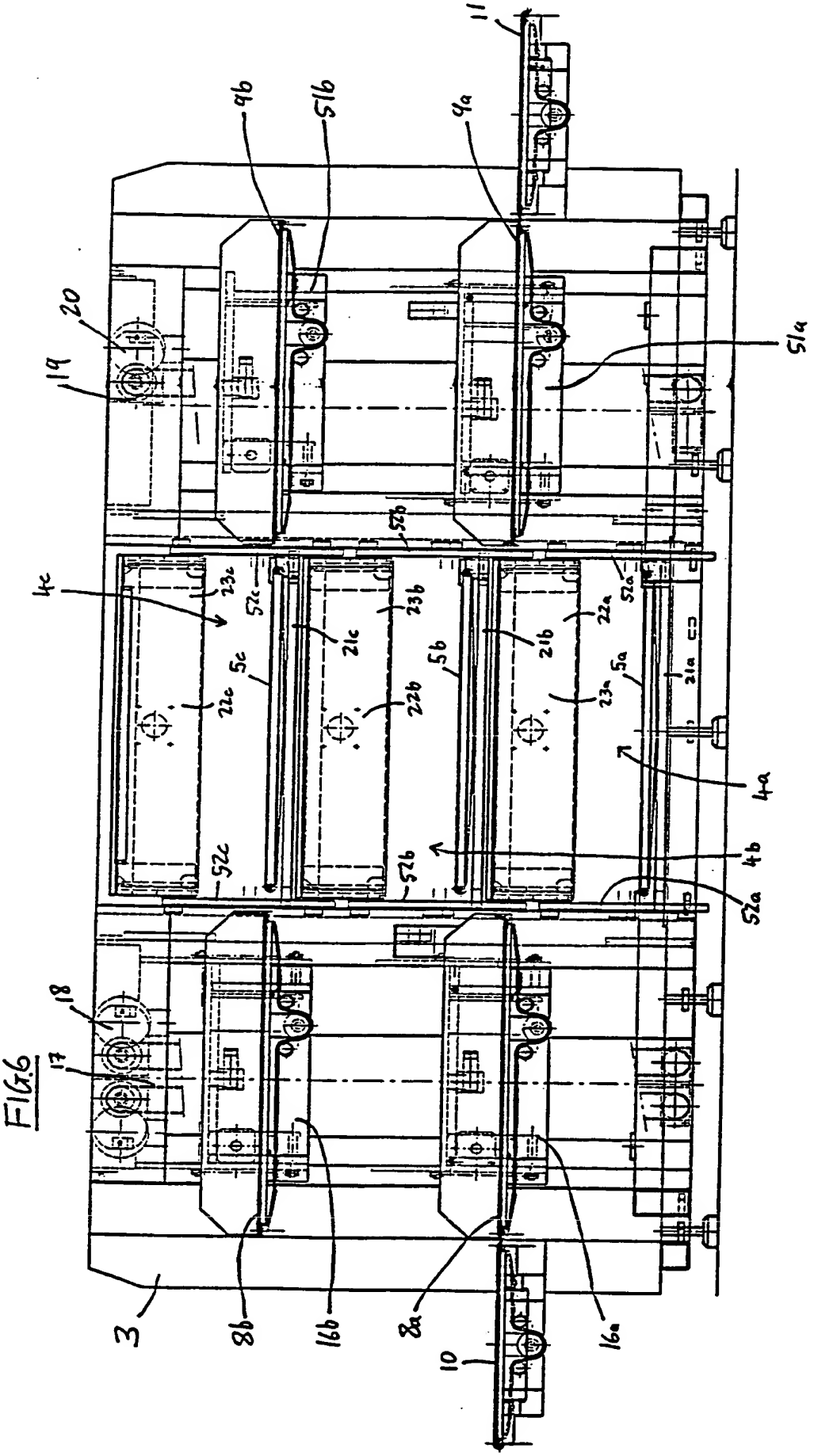


FIG 5

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9b
51b
9a
20
19
51a
52b
4c
23c
52c
21c
23b
22b
5b
21b
22a
52a
5c
22c
5a
23a
21a
4a
4b
52a
18
17
3
8b
16b
8a
10
16a

FIG.6

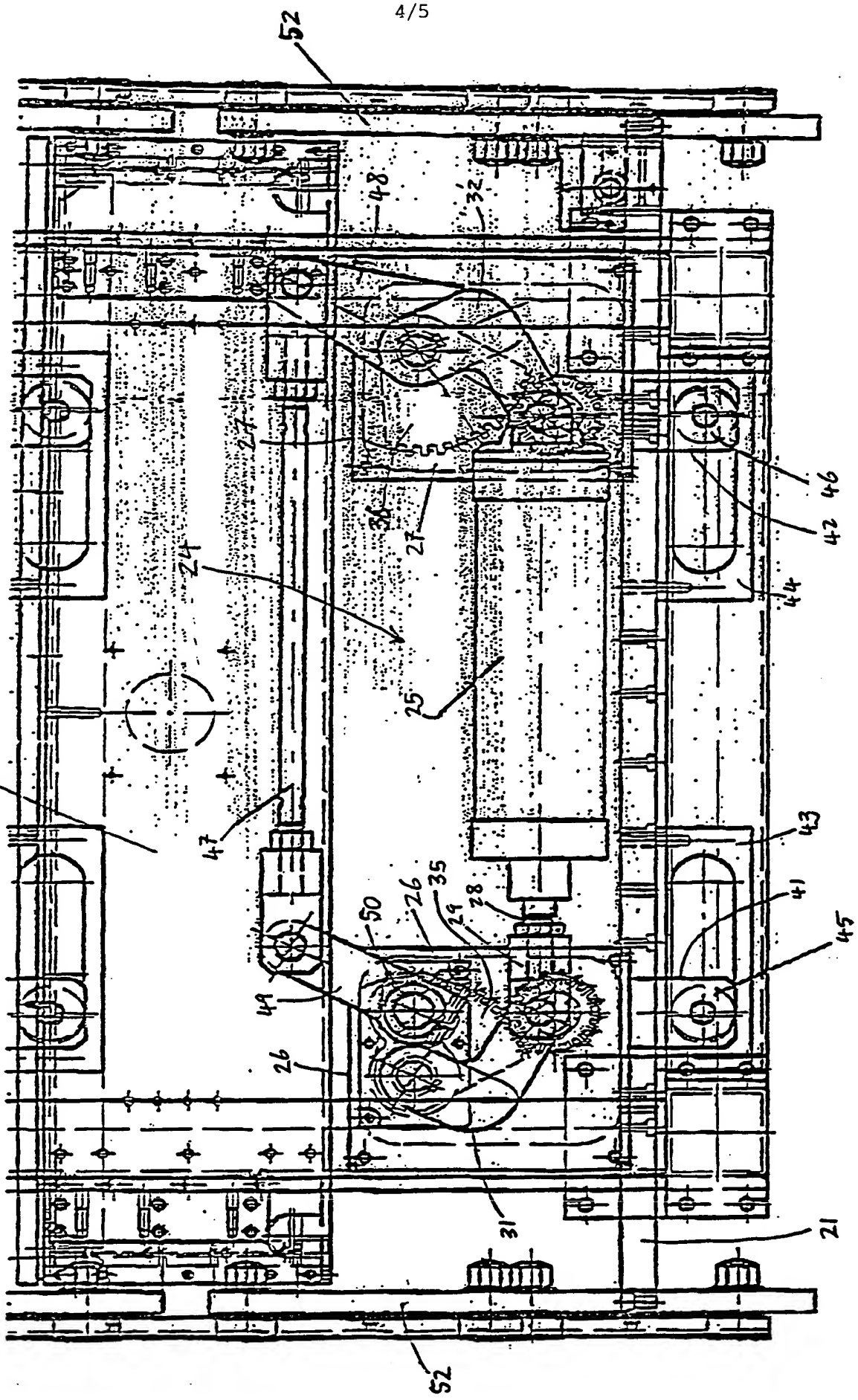


FIG7

FIG.8

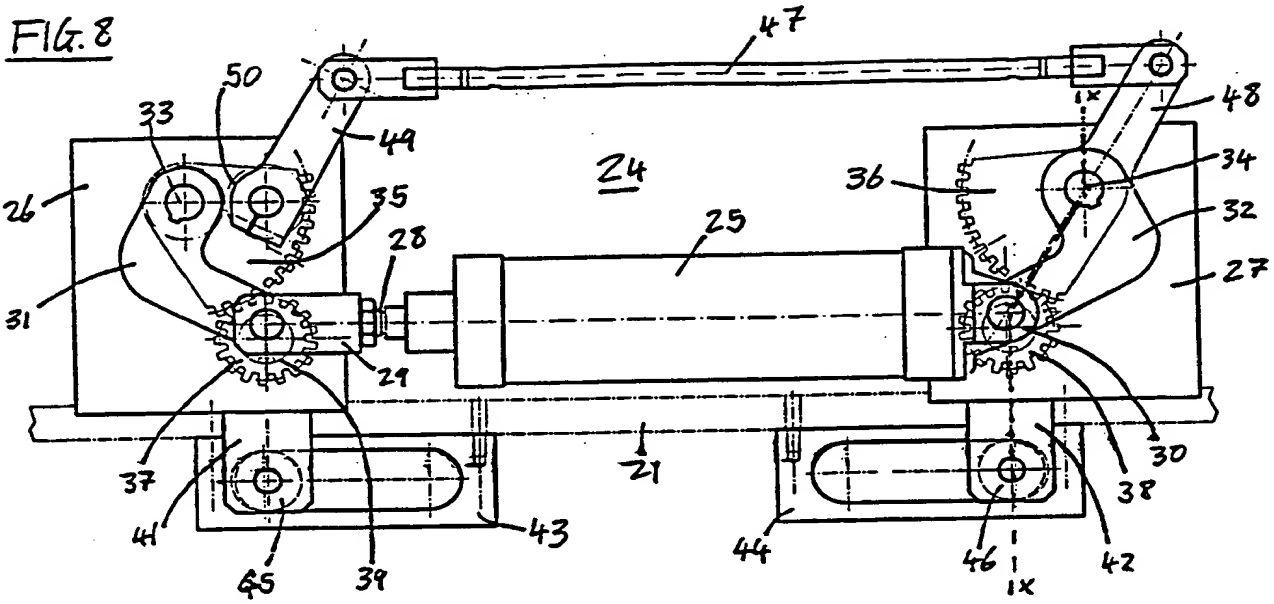


FIG.9

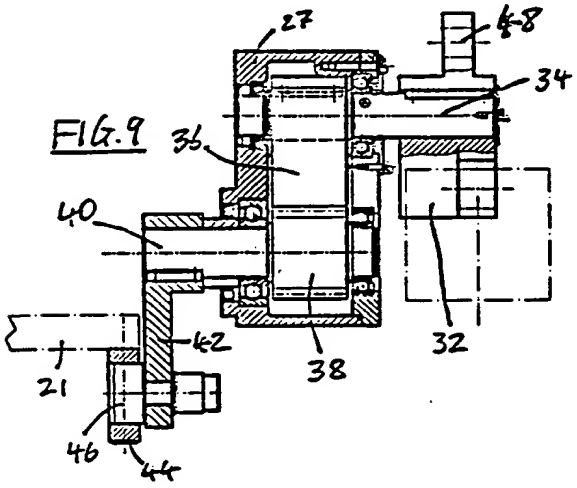


FIG.10

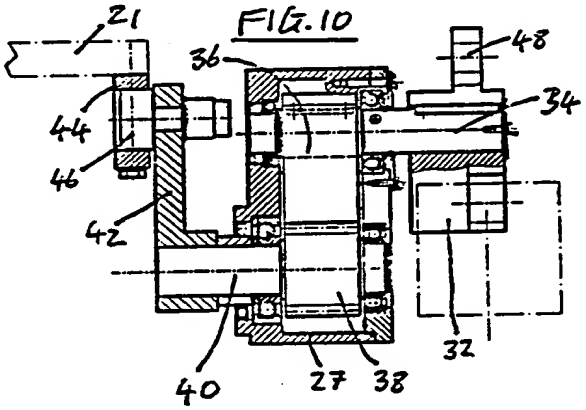
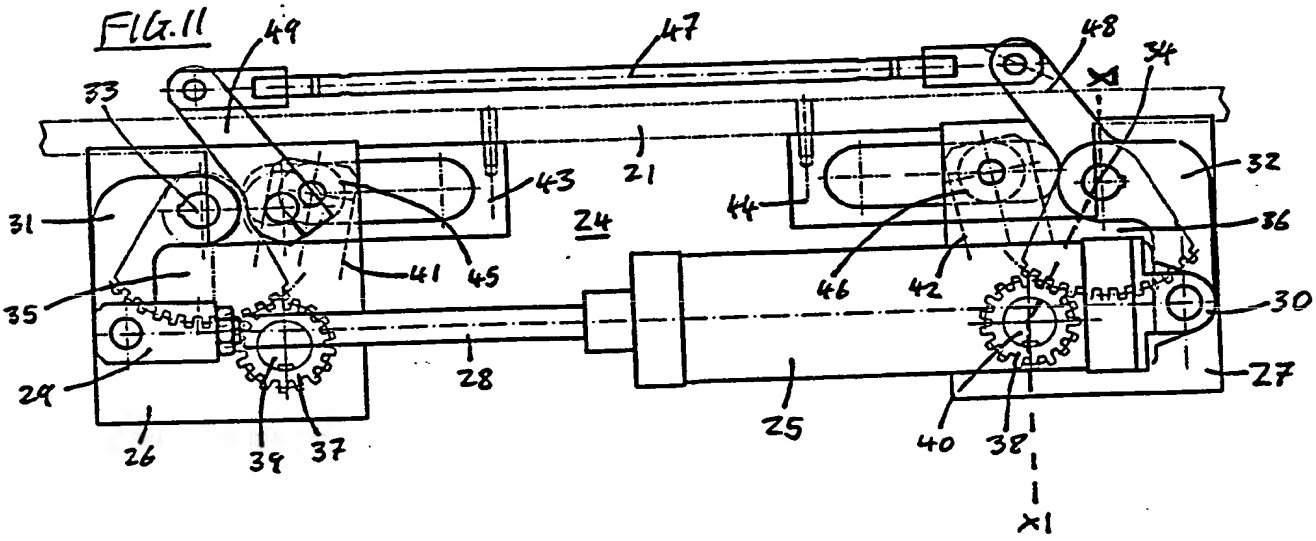


FIG.11



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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
B65B 31/02

A3

(11) International Publication Number: WO 00/27706

(43) International Publication Date: 18 May 2000 (18.05.00)

(21) International Application Number: PCT/EP99/08131

(22) International Filing Date: 27 October 1999 (27.10.99)

(30) Priority Data:
98308823.8 28 October 1998 (28.10.98) EP

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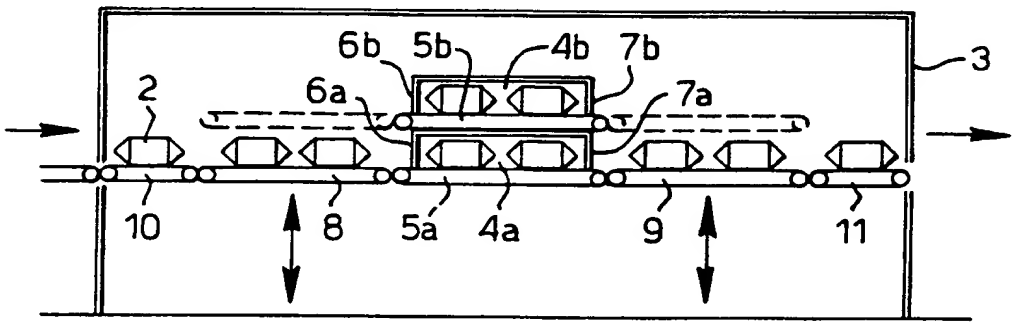
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(88) Date of publication of the international search report:
3 August 2000 (03.08.00)

(54) Title: VACUUM PACKAGING MACHINE



(57) Abstract

A vacuum packaging machine for performing a vacuum sealing operation on product packages, comprises a vertical stack of vacuum chambers (4) which each manage to receive at least one unsealed product package (2) and are operable to perform an independent vacuum sealing operation on the at least one product package (2). A conveyor arrangement (8, 9) is operable to load and unload a selected vacuum chamber (4) with the at least one product package, and the machine is arranged to operate the respective vacuum chambers (4) to perform the vacuum sealing operation while the conveyor arrangement is operated to load and unload another vacuum chamber (4). The conveyor arrangement loads and unloads the vacuum chambers in sequence, and the vacuum chambers are synchronously operated to perform the vacuum sealing operation to allow the conveyor arrangement to operate continuously. The conveyor arrangement comprises at least one in–feed conveyor (8) and at least one out–feed conveyor (9) which are independently movable to select the vacuum chamber to be loaded and unloaded. There may be a plurality of in–feed conveyors (8) and a plurality of out–feed conveyors (9). The vacuum chambers each have a sealing bar arranged along one side for sealing the product packages (2).

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onal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65B31/02

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